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PHARMACOGRAPHIA.

PHARMACOGRAPHIA

A

HISTORY

OF THE PRINCIPAL DRUGS

OF VEGETABLE ORIGIN,

MET WITH IN

GREAT BRITAIN AND BRITISH INDIA

BY

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PREFACE.

PHARMACOGRAPHIA, the word which gives the title to this book, indicates the nature of the work to which it has been prefixed. The term means simply a *writing about drugs;* and it has been selected not without due consideration, as in itself distinctive, easily quoted, and intelligible in many languages.

Pharmacographia, in its widest sense, embodies and expresses the joint intention of the authors. It was their desire, not only to write upon the general subject, and to utilize the thoughts of others; but that the book which they had decided to produce together, should contain observations that no one else had written down. It is in fact a record of personal researches on the principal drugs derived from the vegetable kingdom, together with such results of an important character as have been obtained by the numerous workers on Materia Medica in Europe and America.

Unlike most of their predecessors in Great Britain during this century, the authors have not included in their programme either Pharmacy or Therapeutics; nor have they attempted to give their work that diversity of scope which would render it independent of collateral publications on Botany and Chemistry.

While thus restricting the field of their inquiry, the authors have endeavoured to discuss with fuller detail many points of interest which are embraced in the special studies of the pharmacist; and at the same time have occasionally indicated the direction in which further investigations are desirable. A few remarks on the heads under which each particular article is treated, will explain more precisely their design.

The drugs included in the present work are chiefly those which are commonly kept in store by pharmacists, or are known in the drug and spice market of London. The work

likewise contains a comparatively small number which belor to the *Pharmacopœia of India:* the appearance of this volun seemed to present a favourable opportunity for giving son more copious notice of the latter than has hitherto be attempted.

Supplementary to these two groups must be placed a ve few substances which possess little more than historical intere and have been introduced rather in obedience to custom a for the sake of completeness than on account of their intrin value.

Each drug is headed by the Latin name, followed by su few synonyms as may suffice for perfect identification, togeth in most cases with the English, French, and German designatio

In the next section, the *Botanical Origin* of the substan is discussed, and the area of its growth, or locality of its pr duction is stated. Except in a few instances, no attempt h been made to furnish botanical descriptions of the plants which reference is made. Such information may readily obtained from original and special sources, where moreov figures of the plants may not unfrequently be found.

Under the head of *History*, the authors have endeavour to trace the introduction of each substance into medicine, a to bring forward other points in connexion therewith, whi have not hitherto been much noticed in any recent wor This has involved researches which have been carried on f several years, and has necessitated the consultation of ma works of general literature. The exact titles of these wor have been scrupulously preserved, in order to enable the read to verify the statements made, and to prosecute further historic inquiries. In this portion of their task, the authors have acknowledge the assistance kindly given them by Professors He of Stuttgart, Winkelmann of Heidelberg, Monier Williams Oxford, Dümichen of Strassburg; and on subjects connect with China, by Mr. A. Wylie and Dr. Bretschneider. The operation in various directions of many other friends has be acknowledged in the text itself.

In some instances the *Formation, Secretion* or *Meth of Collection* of a drug, has been next detailed: in othe the section *History* has been immediately followed by t

Description, succeeded by one in which the more salient features of *Microscopic Structure* have been set forth. The authors have not thought it desirable to amplify the last-named section, as the subject deserves to be treated in a special work, and to be illustrated by engravings. Written descriptions of microscopic structure are tedious and uninteresting, and however carefully drawn up, must often fail to convey the true meaning which would be easily made evident by the pencil. The reader who wishes for illustrations of the minute structure of drugs may consult the works named in the foot-note.[1]

The next division includes the important subject of *Chemical Composition*, in which the authors have striven to point out to the reader familiar with chemistry, what are the constituents of greatest interest in each particular drug,—what the characters of the less common of those constituents,—and by whom and at what date the chief investigations have been made. A knowledge of the name and date provides a clue to the original memoir, which may usually be found either *in extenso* or in abstract, in more than one periodical. It has been no part of the authors' plan to supersede reference to standard works on chemistry, or to describe the chemical characters of substances which may be easily ascertained from those sources of information which should be within the reach of every pharmaceutical inquirer.

In the section devoted to *Production and Commerce*, the authors have given such statistics and other trade information as they could obtain from reliable sources; but they regret that this section is of very unequal value. Duties have been abolished, and a general and continuous simplification of tariffs and trade regulations has ensued. The details therefore that used to be preserved regarding the commerce in drugs, exist no longer in anything like their former state of completeness: hence the fragmentary nature of much of the information recorded under this head.

[1] Berg (Otto) *Anatomischer Atlas zur pharmazeutischen Waarenkunde*, Berlin, 1865. 4to. with 50 plates.

Fluckiger (F. A.) *Grundlagen der pharmaceutischen Waarenkunde, Einleitung in das Studium der Pharmacognosie*, Berlin, 1873. 8vo.

Planchon (Gustave) *Traité pratique de la détermination des drogues simples d'origine végétale*, Paris, 1874. 8vo. (in progress).

The medicinal uses of each particular drug are only slightly mentioned, it being felt that the science of therapeutics lies within the province of the physician, and may be wisely relinquished to his care. At the same time it may be remarked that the authors would have rejoiced had they been able to give more definite information as to the technical or economic uses of some of the substances they have described.

What has been written under the head of *Adulteration* is chiefly the result of actual observation, or might otherwise have been much extended. The authors would rather rely on the characters laid down in preceding sections than upon empirical methods for the determination of purity. The heading *Substitutes* has been adopted for certain drugs, more or less related to those described in special articles, yet not actually used by way of adulteration.

A work professing to bring together the latest researches in any subject will naturally be thought to contain needless innovations. Whilst deprecating the inconvenience of changes of nomenclature, the authors have had no alternative but to adopt the views sanctioned by the leaders of chemical and botanical science, and which the progress of knowledge has required. The common designations of drugs may indeed remain unchanged:—hellebore, aconite, colchicum, anise and caraway, need no modernizing touch. But when we attempt to combine with these simple names, words to indicate the organ of the plant of which they are constituted, questions arise as to the strict application of such terms as root, rhizome, tuber, corm, seed, and fruit, about some or all of which a diversity of opinion may be entertained.

It has been the authors' aim to investigate anew the field of Vegetable Materia Medica, in order as far as possible to clear up doubtful points, and to remove some at least of the uncertainties by which the subject is surrounded. In furtherance of this plan they have availed themselves of the resources offered by Ancient and Modern History; nor have they hesitated to lay under contribution either the teaching of men eminent in science, or the labours of those who follow the paths of general literature. How far they have accomplished their desire, remains for the public to decide.

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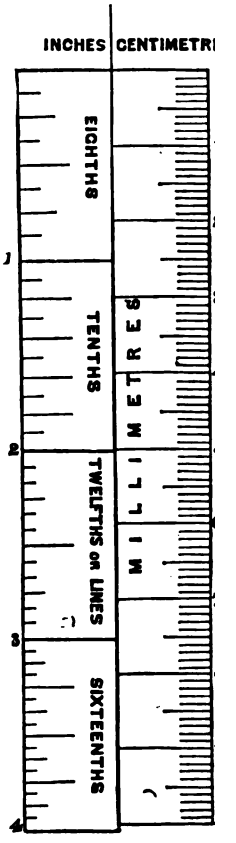
EXPLANATIONS.

Thermometer—The *Centigrade Thermometer* has bee alone adopted. A table comparing its degrees with those Fahrenheit's scale is given opposite.

Polarization—Most essential oils, and the solutions several substances described in this book are capable of effectin the deviation of a ray of polarized light. The amount of th rotatory power is greatly influenced by various causes, and ca hardly be regarded as constant in many essential oils. As alkaloids and other compounds of organic origin, the deviatic much depends upon the nature and quantity of the solvent. Tl authors have thought it needful to record in numerous cases the results of such optical investigations, as determined by the *Polaristrobometer* invented by Wild of St. Petersburg, and described in Poggendorff's *Annalen der Physik und Chemie*, vol. 122 (1864) p. 626; or more completely in the *Bulletin de l'Académie impériale des Sciences de St. Pétersbourg*, tome viii. (1869) p. 33.



Measurements—The authors regret to have been unable to adopt one standard system of stating measurements. They have mostly employed the English inch: the accompanying wood-cut will facilitate its comparison with the French decimal scale. The word *millimetre* is indicated in the text by the contraction *mm.*; *micromillimetre*, signifying the thousandth part of a millimetre, and only used in reference to the microscope, is abbreviated thus, *mkm*.

TABLE for comparing the degrees of the Centigrade Thermometer with those of Fahrenheit's Scale.

CENT	FAHR	CENT	FAHR	CENT	FAHR	CENT	FAHR
− 29	20·2	+ 41	+ 105·8	+ 111	+ 231·8	+ 181	+ 357·8
28	18·4	42	107·6	112	233·6	182	359·6
27	16·6	43	109·4	113	235·4	183	361·4
26	14·8	44	111·2	114	237·2	184	363·2
25	13·0	45	113·0	115	239·0	185	365·0
24	11·2	46	114·8	116	240·8	186	366·8
23	9·4	47	116·6	117	242·6	187	368·6
22	7·6	48	118·4	118	244·4	188	370·4
21	5·8	49	120·2	119	246·2	189	372·2
20	4·0	50	122·0	120	248·0	190	374·0
19	2·2	51	123·8	121	249·8	191	375·8
18	0·4	52	125·6	122	251·6	192	377·6
17	+ 1·4	53	127·4	123	253·4	193	379·4
16	3·2	54	129·2	124	255·2	194	381·2
15	5·0	55	131·0	125	257·0	195	383·0
14	6·8	56	132·8	126	258·8	196	384·8
13	8·6	57	134·6	127	260·6	197	386·6
12	10·4	58	136·4	128	262·4	198	388·4
11	12·2	59	138·2	129	264·2	199	390·2
10	14·0	60	140·0	130	266·0	200	392·0
9	15·8	61	141·8	131	267·8	201	393·8
8	17·6	62	143·6	132	269·6	202	395·6
7	19·4	63	145·4	133	271·4	203	397·4
6	21·2	64	147·2	134	273·2	204	399·2
5	23·0	65	149·0	135	275·0	205	401·0
4	24·8	66	150·8	136	276·8	206	402·8
3	26·6	67	152·6	137	278·6	207	404·6
2	28·4	68	154·4	138	280·4	208	406·4
1	30·2	69	156·2	139	282·2	209	408·2
0	32·0	70	158·0	140	284·0	210	410·0
− 1	33·8	71	159·8	141	285·8	211	411·8
2	35·6	72	161·6	142	287·6	212	413·6
3	37·4	73	163·4	143	289·4	213	415·4
4	39·2	74	165·2	144	291·2	214	417·2
5	41·0	75	167·0	145	293·0	215	419·0
6	42·8	76	168·8	146	294·8	216	420·8
7	44·6	77	170·6	147	296·6	217	422·6
8	46·4	78	172·4	148	298·4	218	424·4
9	48·2	79	174·2	149	300·2	219	426·2
10	50·0	80	176·0	150	302·0	220	428·0
11	51·8	81	177·8	151	303·8	221	429·8
12	53·6	82	179·6	152	305·6	222	431·6
13	55·4	83	181·4	153	307·4	223	433·4
14	57·2	84	183·2	154	309·2	224	435·2
15	59·0	85	185·0	155	311·0	225	437·0
16	60·8	86	186·8	156	312·8	226	438·8
17	62·6	87	188·6	157	314·6	227	440·6
18	64·4	88	190·4	158	316·4	228	442·4
19	66·2	89	192·2	159	318·2	229	444·2
20	68·0	90	194·0	160	320·0	230	446·0
21	69·8	91	195·8	161	321·8	231	447·8
22	71·6	92	197·6	162	323·6	232	449·6
23	73·4	93	199·4	163	325·4	233	451·4
24	75·2	94	201·2	164	327·2	234	453·2
25	77·0	95	203·0	165	329·0	235	455·0
26	78·8	96	204·8	166	330·8	236	456·8
27	80·6	97	206·6	167	332·6	237	458·6
28	82·4	98	208·4	168	334·4	238	460·4
29	84·2	99	210·2	169	336·2	239	462·2
30	86·0	100	212·0	170	338·0	240	464·0
31	87·8	101	213·8	171	339·8	241	465·8
32	89·6	102	215·6	172	341·6	242	467·6
33	91·4	103	217·4	173	343·4	243	469·4
34	93·2	104	219·2	174	345·2	244	471·2
35	95·0	105	221·0	175	347·0	245	473·0
36	96·8	106	222·8	176	348·8	246	474·8
37	98·6	107	224·6	177	350·6	247	476·6
38	100·4	108	226·4	178	352·4	248	478·4
39	102·2	109	228·2	179	354·2	249	480·2
40	104·0	110	230·0	180	356·0	250	482·0

PHARMACOGRAPHIA.

CORRIGENDA.

Page 55, 9th line from top, *for* 1871, *read* 1869.

" 141, 7th line from bottom, *for* Fritz, *read* Fitz.

" 213, 7th line from top, *alter formula thus*

$$2(C^{12}H^{21}O^{11})Pb + 2(C^{12}H^{22}O^{11}).$$

" 394, 24th line from top, *for* Brufnels, *read* Brunfels.

" 495, 13th line from bottom, *for* HUMILI *read* HUMULI.

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PHARMACOGRAPHIA.

I.—PHÆNOGAMOUS OR FLOWERING PLANTS.

Dicotyledons.

RANUNCULACEÆ.

RADIX HELLEBORI NIGRI.

Radix Ellebori nigri, Radix Melampodii; Black Hellebore Root;
F. *Racine d'Ellebore noir;* G. *Schwarze Niesswurzel.*

Botanical Origin—*Helleborus niger* L., a low perennial herb, native of sub-alpine woods in Southern and Eastern Europe. It is found in Provence, Northern Italy, Salzburg, Bavaria, Austria, Bohemia, and Silesia, as well as, according to Boissier,[1] in Continental Greece.

Under the name of *Christmas Rose*, it is often grown in English gardens on account of its handsome white flowers, which are put forth in mid-winter.

History—The story of the daughters of Prœtus, king of Argos, being cured of madness by the soothsayer and physician Melampus, who administered to them hellebore, has imparted great celebrity to the plant under notice.[2]

But admitting that the medicine of Melampus was really the root of a species of *Helleborus*, its identity with that of the present plant is extremely improbable. Several other species grow in Greece and Asia Minor, and Schroff[3] has endeavoured to show that of these, *H. orientalis* Lam. possesses medicinal powers agreeing better with the ancient accounts than those of *H. niger* L. He has also pointed out that the ancients employed not the entire root but only the bark separated from the woody column; and that in *H. niger* and *H. viridis* the peeling of the rhizome is impossible, but that in *H. orientalis* it may be easily effected.

[1] *Flora Orientalis*, i. (1867) 61.

[2] See the list of theses and memoirs on Hellebore given by Mérat and De Lens *loc. cit.* iii. 472, 473.

[3] *Zeitschr. d. Gesellsch. d. Aerzte zu Wien.* 1860, No. 25; Canstatt's *Jahresbericht* for 1859. i. 47. 1860. i. 55.

According to the same authority the hellebores differ extremely in their medicinal activity. The most potent is *H. orientalis* Lam.; then follow *H. viridis* L. and *H. fœtidus* L. (natives of Britain), and *H. purpurascens* Waldst. et Kit., a Hungarian species, while *H. niger* is the weakest of all.[1]

Description—Black Hellebore produces a knotty, fleshy, brittle rhizome which creeps and branches slowly, forming in the course of years an entangled, interlacing mass, throwing out an abundance of stout, straight roots. Both rhizome and roots are of a blackish brown, but the younger roots are of lighter tint and are covered with a short woolly tomentum.

In commerce the rhizome is found with the roots more or less broken off and detached. It is in very knotty irregular pieces, 1 to 2 or 3 inches long and about $\frac{2}{10}$ to $\frac{3}{10}$ of an inch in diameter, internally whitish and of a horny texture. If cut transversely (especially after maceration), it shows a circle of white woody wedges 8 to 12 in number, surrounded by a thick bark. The roots are unbranched, scarcely $\frac{1}{10}$ of an inch in diameter. The younger when broken across exhibit a thick bark encircling a simple woody cord; in the older this cord tends to divide into converging wedges which present a stellate appearance, though not so distinctly as in *Actæa*. The drug when cut or broken has a slight odour like that of senega. Its taste is bitterish and slightly acrid.

Microscopic Structure—The cortical part both of the rhizome and the rootlets exhibits no distinct medullary rays. In the rootlets the woody centre is comparatively small and enclosed by a narrow zone somewhat as in sarsaparilla. A distinct pith occurs in the rhizome but not always in the rootlets, their woody column forming one solid bundle or being divided into several. The tissue contains small starch granules and drops of fatty oil.

Chemical Composition—The earlier investigations of Black Hellebore by Gmelin, and Feneulle and Capron, and of Riegel indicated only the presence of the more usual constituents of plants.

Bastick on the other hand in 1852 obtained from the root a peculiar, non-volatile, crystalline, chemically-indifferent substance which he named *Helleborin*. It is stated to have a bitter taste and to produce in addition a tingling sensation on the tongue; to be slightly soluble in water, more so in ether, and to dissolve freely in alcohol.

Marmé and A. Husemann extracted helleborin (1864) by treating with hot water the green fatty matter which is dissolved out of the root by boiling alcohol. After recrystallization from alcohol, it is obtainable in shining, colourless needles, having the composition $C^{36}H^{42}O^{6}$. It is stated to be highly narcotic. Helleborin appears to be more abundant in *H. viridis* (especially in the older roots) than in *H. niger*, and yet to be obtainable only to the extent of 0·4 per mille. When it is boiled with dilute sulphuric acid, or still better with solution of zinc chloride, it is converted into sugar and *Helleboresin*, $C^{30}H^{38}O^{4}$.

Marmé and Husemann succeeded in isolating other crystallized principles from the leaves and roots of *H. niger* and *H. viridis*, by precipitation with phospho-molybdic acid. They obtained firstly a

[1] Between *purpurascens* and *niger*, Schroff places *H. ponticus* A. Br., a plant which Boissier holds to be simply *H. orientalis* Lam.

slightly acid glucoside which they named *Helleboreïn.* It occurs only in very small proportion, but is rather more abundant in *H. niger* than in *H. viridis.* When boiled with a dilute acid, helleboreïn, $C^{26}H^{44}O^{15}$, is resolved into *Helleboretin*, $C^{14}H^{20}O^{3}$, of a fine violet colour, and sugar, $C^{12}H^{24}O^{12}$. It is remarkable that helleboretin has no physiological action, though helleboreïn is stated to be poisonous.

An organic acid accompanying helleborin was regarded by Bastick as probably aconitic (equisetic) acid. There is no tannin in hellebore.

Uses—Black Hellebore is reputed to be a drastic purgative. In British medicine its employment is nearly obsolete, but the drug is still imported from Germany and sold for the use of domestic animals.

Adulteration—Black Hellebore root as found in the market is not always to be relied on, and without good engravings, it is not easy to point out characters by which its genuineness can be made certain. In fact to ensure its recognition, some of the German pharmacopœias require that it should be supplied with leaves attached.

The roots with which it is chiefly liable to be confounded are the following:—

1. *Helleborus viridis* L.—Although a careful comparison of authenticated specimens reveals certain small differences between the roots and rhizomes of this species and of *H. niger*, there are no striking characters by which they can be discriminated. The root of *H. viridis* is far more bitter and acrid than that of *H. niger*, and it exhibits more numerous drops of fatty oil. In German trade the two drugs are supplied separately, both being in use; but as *H. viridis* is apparently the rarer plant and its root is valued at 3 to 5 times the price of that of *H. niger*, it is not likely to be used for sophisticating the latter.

2. *Actæa spicata* L.—In this plant the rhizome is much thicker; the rootlets broken transversely display a cross or star. The drug has but little odour; as it contains tannin its infusion is blackened by a persalt of iron, which is not the case with an infusion of Black Hellebore.

RHIZOMA COPTIDIS.

Radix Coptidis; Coptis Root, Mishmi Bitter, Mishmi Tita.

Botanical Origin—*Coptis Teeta* Wallich, a small herbaceous plant still but imperfectly known, indigenous to the Mishmi mountains, eastward of Assam. It was first described in 1836 by Wallich.[1]

History—This drug under the name of *Mahmira* is used in Sind for inflammation of the eyes, a circumstance which enabled Pereira[2] to identify it with a substance bearing a nearly similar designation mentioned by the early writers on medicine and previously regarded as the root of *Chelidonium majus* L.

Thus we find that Paulus Ægineta in the 7th century was acquainted with a knotty root named Μαμιρὰς. Rhazes who according to Choulant died in A.D. 923 or 932, mentions *Mamiran*, and it is also noticed by Avicenna a little later as a drug useful in diseases of the eye.

[1] *Trans. of Med. and Phys. Soc. of Calcutta*, viii (1836) 85.

[2] *Pharm. Journ.* xi. (1852) 294.

Ibn Baytar in the 13th century called the drug *Mamiran* and *Uruk*, and described it as a small yellow root like turmeric, coming from China. Other writers of the middle ages allude to it under the name of *Memeren*.

Hajji Mahomed in the account of Cathay which he gave to Ramusio (*circa* A.D. 1550) says that the *Mambroni chini*, by which we understand the root in question, is found in the mountains of Succuir (Suh-cheu) where rhubarb grows and that it is a wonderful remedy for diseases of the eye.[1] In an official report published at Lahore in 1862,[2] *Mamiran-i-chini* is said to be brought from China to Yarkand.

The rhizome of *Coptis* is used by the Chinese under the names *Hwang-lien* and *Chuen-lien*.[3] It is enumerated by Cleyer[4] (1682) as "*radix pretiosa amara*," and was described in 1778 by Bergius[5] who received it from Canton.

More recently it was the subject of an interesting notice by Guibourt[6] who thought it to be derived from *Ophioxylon serpentinum* L., an apocyneous plant widely removed from *Coptis*. Its root was recommended in India by MacIsaac[7] in 1827 and has been subsequently employed with success by many practitioners.

There is a rude figure of the plant in the Chinese herbal *Pun-tsao*.

Description—*Tita*, as the drug is called in the Mishmi country whence it is sent by way of Sudiya on the Bramaputra to Bengal, is a rhizome about the thickness of a quill occurring in pieces an inch or two in length. It often branches at the crown into two or three heads, and bears the remains of leafstalks and thin wiry rootlets, the stumps of which latter give it a rough and spiny appearance. It is nearly cylindrical, often contorted, and of a yellowish brown colour. The fracture is short, exhibiting a loose structure with large bright yellow radiating woody bundles. The rhizome is intensely bitter but not aromatic even when fresh.

It is found in the Indian bazaars in neat little open-work bags formed of narrow strips of rattan, each containing about half an ounce. We have once seen it in bulk in the London market.[8]

Microscopic Structure—Cut transversely the rhizome exhibits an inner cortical tissue, through which sclerenchymatous groups of cells are scattered. The latter are most obvious on account of their bright yellow colour. In the woody central column a somewhat concentric arrangement is found, corresponding to two or three periods of annual growth. The pith, not the medullary rays, begins to be obliterated at an early period. The structure of the drug is, on the whole, very irregular on account of the branches and numerous rootlets arising from it.

The medullary rays contain small starch granules, while the bark as well as the pith are richer in albuminous or mucilaginous matters.

Chemical Composition—The colouring matter in which the

[1] Yule, *Cathay and the way thither* (Hakluyt Society) i. (1866) p. ccxvi.

[2] Davies, *Report on the trade of the countries on the N. W. boundary of India*, Lahore, 1862.

[3] Otherwise written *Honglane, Chonlin, Chynlen, Chouline, Souline, &c.*

[4] *Specimen Medicinæ Sinicæ*, Med. Simp. No. 27.

[5] *Mat. Med.* ii. (1778) 908.

[6] *Hist. des Drog.* ii. (1849) 526.

[7] *Trans. of Med. and Phys. Soc. of Calcutta*, iii. (1827) 432.

[8] Two cases were offered for sale as *Olen* or *Mishmee* by Messrs. Gray and Clark, drug-brokers, 25 Nov. 1858.

rhizome of *Coptis* abounds, is quickly dissolved by water. If the yellow solution obtained by macerating it in water is duly concentrated, nitric acid will produce an abundant heavy precipitate of minute yellow crystals, which if redissolved in a little boiling water will separate again in stellate groups. Solution of iodine also precipitates a cold infusion of the root.

These reactions as well as the bitterness of the drug are due to a large proportion of *Berberine*, as proved by J. D. Perrins.[1] The rhizome yielded not less than 8½ per cent., which is more than has been met with in any other of the numerous plants containing that alkaloid.

As pure berberine is scarcely dissolved by water, it must be combined in *Coptis* with an acid forming a soluble salt. Further researches are requisite to determine the nature of this acid. In some plants berberine is accompanied by a second basic principle: whether in the present instance such is the case, has not been ascertained.

Uses—The drug has been introduced into the *Pharmacopœia of India* as a pure, bitter tonic.

Substitutes—*Thalictrum foliolosum* DC., a tall plant common at Mussooree and throughout the temperate Himalaya at 5000—8000 feet, as well as on the Khasia Hills, affords a yellow root which is exported from Kumaon under the name *Momiri*. From the description in the *Pharmacopœia of India*, it would appear to much resemble the *Mishmi Tita*, and it is not impossible that some of the observations made under the head *History* (p. 3) may apply to *Thalictrum* as well as to *Coptis*.

In the United States the rhizome of *Coptis trifolia* Salisb., a small herb indigenous to the United States and Arctic America, and also found in European and Asiatic Russia, is employed for the same purposes as the Indian drug. It has been recently shown to contain berberine and another crystalline principle.[2]

SEMEN STAPHISAGRIÆ.

Stavesacre; F. *Staphisaigre*; G. *Stephanskörner, Läusesamen*

Botanical Origin—*Delphinium Staphisagria* L., a stout erect, biennial herb growing 3 to 4 feet high with palmate, 5- to 9-lobed leaves, which as well as the rest of the plant are softly pubescent.

It is a native of Italy, Greece, the Greek Islands and Asia Minor growing in waste and shady places; it is now also found throughout the greater part of the Mediterranean regions and in the Canary Islands, but whether in all instances truly indigenous is questionable.

History—Stavesacre was well known to the ancients. It is the ἀγροτέρη σταφὶς of Nicander in the 2nd century B.C.,[3] the σταφὶς ἀγρία of Dioscorides,[4] the *Staphisagria* or *Herba pedicularia* of Scribonius Largus,[5] the *Astaphis agria* or *Staphis* of Pliny.[6] The last-named author mentions the use of the powdered seeds for destroying vermin on the head and other parts of the body.

[1] *Journ. of Chem. Soc.* xv. (1862) 339.

[2] Gross in *Am. Journ. of Pharm.* May 1873. 193.

[3] O. Schneider, *Nicandrea*, Lips. 1856. 271.

[4] *De Mat. Med.* lib. iv. c. 153.

[5] *De Compositione Medicamentorum*, c. 166.

[6] Lib. xxiii. c. 13.

The drug continued in use during the middle ages. Pietro Crescenzio[1] who lived in the 13th century mentions the collection of the seeds in Italy; and Simon Januensis,[2] physician to Pope Nicolas IV. (A.D. 1288—1292), describes them—"*propter excellentem operationem in caputpurgio.*"

Description—The fruit consists of three downy follicles, in each of which about 12 seeds are closely packed in two rows. The seeds (which alone are found in commerce) are about 3 lines in length and rather less in width; they have the form of a very irregular 4-sided pyramid, of which one side, much broader than the others, is distinctly vaulted. They are sharp-angled, a little flattened, and very rough, the testa being both wrinkled and deeply pitted. The latter is blackish-brown, dull and earthy-looking, rather brittle, yet not hard. It encloses a soft, whitish, oily albumen with a minute embryo at its sharper end.

The seeds have a bitter taste and occasion a tingling sensation when chewed. Ten of them weigh about 6 grains.

Microscopic Structure—The epidermis of the seed consists of one layer of large cells, either nearly cubical or longitudinally extended: hence the wrinkles of the surface. The brown walls of these cells are moderately thickened by secondary deposits, which may be made very obvious by macerating thin sections in a solution of chromic acid, 1 p. in 100 p. of water. By this treatment numerous crystals after a short time make their appearance,—without doubt the chromate of one of the alkaloids of staphisagria.

The outer layer of the testa is made up of thin-walled narrow cells, which become larger near the edges of the seed and in the superficial wrinkles. They contain a small number of minute starch granules and are not altered on addition of a salt of iron. The interior layer exhibits a single row of small, densely-packed cells. The albumen is composed of the usual tissue loaded with granules of albuminoid matter and drops of fatty oil.

Chemical Composition—The analyses of Brandes (1819), and of Lassaigne and Feneulle (1819) have shown this drug to contain a basic principle which has been named *Delphinine* or *Delphine*. Erdmann in 1864 assigned it the formula $C^{24}H^{35}NO^2$; he obtained it to the extent of 1 per mille in small rhombohedric crystals fusing at 120° C., soluble in ether, alcohol, chloroform, or benzol. Its salts, except the chromate, appear to be uncrystallizable. The alkaloid has an extremely burning and acrid taste, and is highly poisonous.

Couerbe[3] in 1833 pointed out the presence in stavesacre of a second alkaloid separable from delphinine by ether in which it is insoluble. It is called *Staphisaïne* and has the composition $C^{16}H^{23}NO^2$.

The treatment of the shell of the seed with chromic acid, detailed above, shows that this part of the drug is the principal seat of the alkaloids; and the albumen indeed furnishes no crystals of any chromate. In confirmation of this view we exhausted about 400 grammes of the *entire seeds* with warm spirit of wine acidulated with a little acetic acid. The liquid was allowed to evaporate and the residue mixed with warm water. The solution thus obtained, separated from the resin, yielded on

[1] *Libro della Agricultura*, Venet. (1511) lib. vi. c. 108.

[2] *Clavis Sanationis*, Venet. 1510.

[3] *Ann. de Chimie et de Phys.* lii. (1833) 352.

addition of chromic acid an abundant precipitate of chromate of delphinine. The same solution likewise furnished copious precipitates when bichloride of platinum,[1] iodohydrargyrate of potassium or bichromate of potassium were added. We ascertained that pure acetate of delphinine gives the same reactions with these tests. By repeating the above treatment on a larger scale we obtained crystals of delphinine of considerable size, and also a second alkaloid, not soluble in ether, probably Couerbe's staphisaïne.

In 1864, Darbel in a thesis[2] published at Montpellier, announced the existence of a third alkaloid which he termed *Staphisagrine*—a name which unfortunately has been also applied to staphisaïne.

By exhausting stavesacre seeds with boiling ether, we got 27 per cent. of fatty oil, which continued fluid even at $-5°$ C. It concreted by means of hyponitric acid, and is therefore to be reckoned among the non-drying oils.

The drug air-dry contains 8 per cent. of hydroscopic water. Dried at 100° C., and incinerated it left 8·7 per cent. of ash.

Nothing exact is known of the *Delphinic acid* of Hofschläger (about 1820) said to be crystalline and volatile.

Commerce—The seeds are imported from Trieste and from the south of France, especially from Nismes, near which city as well as in Italy (Puglia) the plant is cultivated.

Uses—Stavesacre seeds are still employed as in old times for the destruction of *pediculi* in the human subject, for which purpose they are reduced to powder which is dusted among the hair. Dr. Balmanno Squire[3] having ascertained that *prurigo senilis* is dependent on the presence of *pediculus*, has recommended an ointment of which the essential ingredient is the fatty oil of stavesacre seeds extracted by ether. It is plain that such a preparation would contain delphinine. Delphinine itself has been used externally in neuralgic affections. Stavesacre seeds are largely consumed for destroying the pediculi that infest cattle.

RADIX ACONITI.

Tuber Aconiti; Aconite Root[4]; F. *Racine d'Aconit*; G. *Eisenhutknollen, Sturmhutknollen.*

Botanical Origin—*Aconitum Napellus* L.—This widely-diffused and most variable species grows chiefly in the mountainous districts of the temperate parts of the northern hemisphere.

It is of frequent occurrence throughout the chain of the Alps up to more than 6500 feet, the Pyrenees, the mountains of Germany and Austria, and is also found in Denmark and Sweden. It has become naturalized in a few spots in the west of England and in South Wales. Eastward it grows throughout the whole of Siberia, extending to the mountain ranges of the Pacific coast of North America. It occurs in company with other species on the Himalaya at 10,000 to 16,000 feet above the sea-level.

The plant is cultivated for medicinal use and also for ornament.

[1] The platinic compound is in fine microscopic crystals.

[2] *Recherches chimiques et physiologiques sur les alcaloïdes du Delphinium Staphisagria.*

[3] *Pharm. Journ.* vi. (1865) 405.

[4] We use the word *root* as most in accordance with the teaching of English botanists.

History—The Ἀκόνιτον of the Greeks and the *Aconitum* of the Romans are held to refer to the genus under notice, if not precisely to *A. Napellus*. The ancients were well aware of the poisonous properties of the aconites, though the plants were not more exactly distinguished until the close of the middle ages.

Aconite has been widely employed as an arrow-poison. It was used by the ancient Chinese,[1] and is still in requisition among the less civilized of the hill tribes of India. Something of the same kind was in vogue among the aborigines of ancient Gaul.[2]

One of the most remarkable facts in the history of the species under notice is that in certain localities its poisonous qualities are not developed, and it is so entirely innocuous that it is used as a potherb! This was pointed out as long ago as 1671 by Martin Bernhard,[3] an eminent Polish physician and botanist, and was confirmed by Linnæus[4] so far as relates to Lapland, where the young shoots of one species are cooked and eaten. It is still more strange to find that while in certain districts of Northern India the roots are collected as a poison, there are others in which the same roots are eaten as "a pleasant tonic."[5]

Störck of Vienna introduced aconite into medical practice about the year 1762.[6]

Description—The herbaceous annual stem of aconite starts from an elongated conical tuberous root 2 to 4 inches long and sometimes as much as an inch in thickness. This root tapers off in a long tail, while numerous branching rootlets spring from its sides. If dug up in the summer it will be found that a second and younger root (occasionally a third) is attached to it near its summit by a very short branch, and is growing out of it on one side. This second root has a bud at the top which is destined to produce the stem of the next season. It attains its maximum development at the latter part of the year, the parent root meanwhile becoming shrivelled and decayed. This form of growth is therefore analogous to that of an orchis.

The dried root is more or less conical or tapering, enlarged and knotty at the summit which is crowned with the base of the stem. It is from 2 to 3 or 4 inches long and at top from ½ to 1 inch thick. The tuber-like portion of the root is more slender, much shrivelled longitudinally, and beset with the prominent bases of rootlets. The drug is of a dark brown; when dry it breaks with a short fracture exhibiting a white and farinaceous, or brownish, or grey inner substance sometimes hollow in the centre. A transverse section of a sound root shows a pure white central portion (pith) which is many-sided and has at each of its projecting angles a thin fibro-vascular bundle.

In the fresh state the root of aconite has a sharp odour of radish which disappears on drying. Its taste which is at first sweetish soon becomes alarmingly acrid, accompanied with sensations of tingling and numbness.

Microscopic Structure—The tuberous root as seen in a transverse

[1] F. Porter Smith, *Mat. Med. and Nat. Hist. of China*, Shanghai, 1871. 2, 3.

[2] Pliny, lib. xxvii. c. 76, also xxv. 25.

[3] Napellus in Poloniâ non venenosus—*Ephem. Acad. Nat. Curios.* Dec. i. ann. 2 (1671) 79.

[4] *Flor. Lapponica*, ed. 2. 1792. 187.

[5] Munro, quoted by Hooker and Thomson, *Flor. Ind.* i. (1855) 58. 2nd part.

[6] *De Stramonio, Hyoscyamo et Aconito*, Vindob. 1762.

section, consists of a central part enclosed by a delicate cambial zone. The outer part of this central portion exhibits a thin brownish layer made up of a single row of cells (*kernscheide* of the Germans). This is more distinctly obvious in the rootlets, which also show numerous, scattered, thick-walled cells of a yellow colour.

The fibro-vascular bundles of aconite root are devoid of true ligneous cells; its tissue is for the largest part built up of uniform parenchymatous cells loaded with starch granules.

Chemical Composition — Aconite contains chemical principles which are of great interest on account of their virulent effects on the animal economy.

The first to be mentioned is *Aconitine*, discovered by Geiger and Hesse in 1833, and obtainable from the root to the extent of 3 or 4 per mille. Von Planta (1850) assigned to it the formula $C^{30}H^{47}NO^{7}$; Duquesnel[1] (1871), whose analysis relates to *crystallized* aconitine (of *A. Napellus*) $C^{34}H^{40}NO^{2}$. For many years it was only known in the form of a light, pulverizable, colourless, amorphous mass. In the London Exhibition of 1862, Morson, the well-known manufacturing chemist, whose aconitine had long been held in great repute, exhibited it in large well-defined crystals. On the same occasion small specimens of the crystallized alkaloid were shown by Groves of Weymouth, and also crystallized hydrochlorate, hydriodate, and nitrate, prepared two years previously by a process he afterwards described in print.[2]

About the year 1858 it became known to chemists that a substance was being sold under the name of *Aconitine*, the properties of which were somewhat diverse from those held to be characteristic of that alkaloid, and there was much doubt and speculation as to its origin. It is now known that this body, which is named *Pseud-aconitine*, and has been also termed *English Aconitine*, *Napelline* (Wiggers), *Nepaline* (Flückiger), and *Acraconitine* (Ludwig), is derived from the aconite called in India *Bish* (see p. 12), which English manufacturing chemists have long preferred (whenever it could be obtained) to the aconite root of Europe.

With these facts in view, and a plentiful supply of each kind of aconite, Groves has re-examined the alkaloids of this drug; and his experiments, though not yet (January 1874) concluded, have established the following facts:—

European aconite root, derived from *A. Napellus*, affords aconitine in two forms,—*crystalline* and *amorphous*. Indian or Nepal aconite root, presumed to be obtained chiefly from *A. ferox*, yields a closely allied substance, *Pseud-aconitine*, also under two forms,—*crystalline* and *amorphous*. The characters by which these substances are distinguished have been thus recorded by Mr. Groves.[3]

Aconitine, whether crystalline or amorphous, does not fuse or soften in boiling water.

Crystalline Pseud-aconitine does not soften in boiling water, but if

[1] *Journ. de Pharm. et de Chim.* xiv. (1871) 94; *De l'Aconitine cristallisée et des préparations d'aconit*, quoted in *Pharm. Journ.* Jan. 27, 1872. 602.

[2] *Pharm. Journ.* viii. (1867) 118.—The crystallized salt shows that the aconitine of Groves was that of *A. Napellus*. We cannot undertake to say whether the crystallized aconitine of Morson was this alkaloid, or whether it was that now known as *Pseud-aconitine*.

[3] *Pharm. Journ.* Oct. 11, 1873. 293—296.

dissolved in an acid and then precipitated by ammonia, the precipitate treated with boiling water coheres and becomes plastic.

Amorphous Pseud-aconitine, boiled in water, fuses, becomes sticky, and adheres to the sides of the vessel.

Crystalline Aconitine is far more soluble in weak aqueous ammonia[1] than its allied alkaloids. The proportions may be roughly stated thus:—cryst. aconitine, 1 part in 500 parts; amorph. aconitine, 1—1000; cryst. pseud-aconitine, 1—2500; amorph. pseud-aconitine, 1—1500.

Aconitine and pseud-aconitine are both deposited in crystals from aqueous ammoniacal solutions. Such a solution of crystalline aconitine speedily undergoes spontaneous decomposition; that of amorphous aconitine is more stable, while similar solutions of pseud-aconitine are but little prone to change.

Crystalline aconitine forms numerous crystallizable salts: crystalline pseud-aconitine appears incapable of affording crystallizable salts.

The crystals of aconitine are described by Groves as being entirely different in form from those of pseud-aconitine. According to Duquesnel those of the former are rhombic or hexagonal tables, sometimes short four-sided prisms.

Duquesnel who has studied with attention the proporties of crystalline aconitine obtained from *A. Napellus* grown in Europe, describes it as anhydrous, nearly insoluble in water even at 100° C. When obtained by precipitation from one of its salts, it is in the form of an amorphous, pulverulent hydrate. The crystals of the alkaloid dissolve in alcohol, ether, acetic ether, benzol, and especially in chloroform which is their best solvent; the solutions have an intensely bitter taste followed by a sensation of pricking and tingling. Crystalline aconitine is freely soluble in dilute acids, easily affording crystallizable salts (especially a nitrate), provided the solution is perfectly neutral; it also forms crystalline compounds with iodine and bromine.

Pseud-aconitine is but little soluble in ether (1 in 100), chloroform (1 in 230), or spirit of wine in the cold, but dissolves more freely in those liquids when heated, crystallizing in large prisms from boiling saturated solutions. Solution of pseud-aconitine has a burning but not a bitter taste.

In 1857, Hübschmann[2] announced the discovery in the root of *A. Napellus* of a new base which he called *Napelline.* It is described as a pulverulent, white, amorphous substance, having a bitter and burning taste, easily soluble in water, chloroform, or alcohol, but insoluble in ether or benzol. The substance has an alkaline reaction, and is a strong base. Hübschmann subsequently (1867) expressed his belief that napelline was identical with one of the alkaloids he had obtained in 1865 from the root of *A. Lycoctonum* L.,[3] and had described as *Acolyctine.*

Groves (1873) has prepared a somewhat similar body from Nepaul aconite, but has not yet determined its identity or otherwise with Hübschmann's napelline—in fact he has expressed the opinion that European and Indian aconite have each its own napelline.

Another alkaloid occurring in aconite was announced in 1864 by T. and H. Smith, of Edinburgh,[4] who named it *Aconella,* but afterwards

[1] A solution containing 1¼ per cent. of ammonia.

[2] Flückiger, in *Pharm. Journ.* Aug. 13, 1870. 121.

[3] Hübschmann's distinct and well-marked, crystallizable alkaloid *Lycoctonine* obtained from that plant, is not known to occur in any of the blue-flowered aconites.

[4] *Pharm. Journ.* v. (1864) 317.

showed it to be identical with *narcotine*. So far as we know, it has not been met with by any other chemist; Groves,[1] in particular, was unable to find it.

The other constituents of aconite root are but imperfectly known. In the preparation of the alkaloids, a dark green mixture of resin and fat is obtained; it is much more abundant in European than in Nepal aconite (Groves). The root contains *Mannite*, as proved by T. and H. Smith (1850), together with cane sugar, and another sugar which reduces cupric oxide even in the cold. Tannin is absent, or is limited to the corky coat. The absence of a volatile alkaloid in the root, as stated at page 12, was proved by Groves in 1866.

Uses—Prescribed in the form of tincture as an anodyne liniment; occasionally given internally in rheumatism.

Adulteration and Substitution—Aconite root, though offered in abundance in the market, is by no means always obtained of good quality. Collected in the mountainous parts of Europe by peasants occupied in the pasturing of sheep and cattle, it is often dug up without due regard to the proper season or even to the proper species,—a carelessness not surprising when regard is had to the miserable price which the drug realizes in the market.[2]

One of the species not unfrequent in the Alps, of which the roots are doubtless sometimes collected, is *A. Störckeanum* Reichenb. In this plant the tuberous roots are developed to the number of three or four, and have an anatomical structure slightly different from that of *A. Napellus*.[3] *A. variegatum* L., *A. Cammarum* Jacq., and *A. paniculatum* Lam. are blue-flowered species having tuberous roots resembling those of *A. Napellus*, but according to Schroff somewhat less active.

The yellow-flowered *A. Anthora* L. and *A. Lycoctonum* L. produce roots which cannot be confounded with those of *A. Napellus* L.

FOLIA ACONITI.

Herba Aconiti; Aconite Leaves; F. *Feuilles d'Aconit;* G., *Eisenhutkraut, Sturmhutkraut.*

Botanical Origin—*Aconitum Napellus* L., see preceding article.

History—Aconite herb was introduced into medicine in 1762 by Storck of Vienna; and was admitted into the London Pharmacopœia in 1788.

Description—The plant produces a stiff, upright, herbaceous, simple stem, 3 to 4 feet high, clothed as to its upper half with spreading, dark green leaves, which are paler on their under side. The leaves are from 3 to 5 or more inches in length, nearly half consisting of the channelled petiole. The blade, which has a roundish outline, is divided down to the petiole into three principal segments, of which the lateral are subdivided into two or even three, the lowest being smaller and less

[1] *Pharm. Journ.* viii. (1867) 123.

[2] Thus the continental druggists are able to offer it in quantity as low as 4*d.* to 5*d.* per lb., and a pound we find, contains fully 150 roots!

[3] See figure in Berg's *Atlas zur pharm. Waarenkunde* (1865) fig. 24.

regular than the others. The segments, which are trifid, are finally cut into 2 to 5 strap-shaped pointed lobes. The leaves are usually glabrous, and are deeply impressed on their upper side by veins which run with but few branchings to the tip of every lobe. The uppermost leaves are more simple than the lower, and gradually pass into the bracts of the beautiful raceme of dull-blue helmet-shaped flowers which crowns the stem.

The leaves have when bruised a herby smell; their taste is at first mawkish but afterwards persistently burning.

Chemical Composition—The leaves contain aconitine in small proportion and also aconitic acid,—the latter in combination with lime.

Aconitic Acid, $C^6H^6O^6$, discovered by Peschier in 1820 in somewhat considerable quantity in the leaves of aconite, occurs also in those of larkspur, and is identical with the *Equisetic Acid* of Braconnot and the *Citridic Acid* of Baup.[1]

Schoonbroodt[2] (1867) on treating the extract with a mixture of alcohol and ether, obtained acicular crystals, which he thought were the so-called *Aconella* of Smith. He further found that the distillate of the plant was devoid of odour, but was acid, and had a burning taste. By saturation with an alkali he obtained from it a crystalline substance, soluble in water, and having a very acrid taste. Experiments made about the same time by Groves,[3] a careful observer, led to opposite results. He distilled on different occasions both fresh herb and fresh roots, and obtained a *neutral* distillate, smelling and tasting strongly of the plant, but entirely devoid of acridity. Hence he concluded that *A. Napellus* contains no volatile acrid principle.

In an extract of aconite that has been long kept, the microscope reveals crystals of aconitate of calcium, as well as of sal ammoniac.

The leaves contain a small proportion of sugar, and a tannin striking green with iron. When dried they yield on incineration 16·6 per cent. of ash.

Uses—In Britain the leaves and small shoots are only used in the fresh state, the flowering herb being purchased by the druggist in order to prepare an inspissated juice,—*Extractum Aconiti*. This preparation, which is considered rather uncertain in its action, is occasionally prescribed for the relief of rheumatism, inflammatory and febrile affections, neuralgia, and heart diseases.

RADIX ACONITI INDICA.

Bish, Bis or Bikh, Indian Aconite Root, Nepal Aconite.

Botanical Origin—The poisonous root known in India as *Bish*, *Bis*, or *Bikh*[4] is chiefly derived from *Aconitun ferox* Wallich, a plant growing 3 to 6 feet high and bearing large, dull-blue flowers, native of

[1] Gmelin, *Chemistry* xi. (1857) 402.

[2] Wittstein's *Vierteljahresschrift*, xviii. (1869) 82.

[3] *Pharm. Journ.* viii. (1867) 118.

[4] The Arabic name *Bish* or Persian *Bis* is stated by Moodeen Sheriff in his *Supplement to the Pharmacopœia of India* (p. 265) to be more a correct designation than *Bikh*, which seems to be a corruption of doubtful origin. We find that the Arabian writer Ibn Baytar gives the word as *Bish* (not *Bikh*).

he temperate and sub-alpine regions of the Himalaya at an elevation of 10,000 to 14,000 feet in Garwhal, Kumaon, Nepal and Sikkim. In the greater part of these districts, other closely allied and equally poisonous species occur, viz. *A. uncinatum* L., *A. luridum* H. f. et Th., *A. palmatum* Don, and also abundantly *A. Napellus* L., which last, as already mentioned, grows throughout Europe as well as in Northern Asia and America. The roots of these plants are collected indiscriminately according to Hooker and Thomson [1] under the name of *Bish* or *Bikh*.

History—The ancient Sanskrit name of this potent drug, *Visha*, signifies simply *poison*, and *Ativisha*, a name which it also bears, is equivalent to "*summum venenum*." *Bish* is mentioned by the Persian physician Alhervi [2] in the 10th century as well as by Avicenna [3] and many other Arabian writers on medicine,—one of whom, Isa Ben Ali, calls it the most rapid of deadly poisons, and describes the symptoms it produces with tolerable correctness.[4]

Upon the extinction of the Arabian school of medicine this virulent drug seems to have fallen into oblivion. It is just named by Acosta (1578) as one of the ingredients of a pill which the Brahmin physicians give in fever and dysentery.[5] There is also a very strange reference to it as "*Bisch*" in the Persian Pharmacopœia of Father Ange, where it is stated [6] that the root though most poisonous when fresh, is perfectly innocuous when dried, and that it is imported into Persia from India, and *mixed with food and condiments as a restorative!* Ange was aware that it was the root of an aconite.

The poisonous properties of *Bish* were particularly noticed by Hamilton (late Buchanan) [7] who passed several months in Nepal in 1802–3: but nothing was known of the plant until it was gathered by Wallich and a description of it as *A. ferox* communicated by Seringe to the Société de physique de Genève in 1822.[8] Wallich himself afterwards gave a lengthened account of it in his *Plantæ Asiaticæ Rariores* (1830).[9]

Description—Balfour whose figure of *A. ferox* is the only one that to our knowledge has been published,[10] describes the plant from a specimen that flowered in the Botanical Garden of Edinburgh as—"having 2—3 fasciculated, fusiform, attenuated tubers, some of the recent ones being nearly 5 inches long, and 1½ inches in circumference, dark-brown externally, white within, sending off sparse, longish branching fibres."

Aconite root has of late been imported into London from India in considerable quantity, and been offered by the wholesale druggists as *Nepal Aconite*.[11] It is of very uniform appearance, and seems derived from a single species, which we suppose to be *A. ferox*. The drug consists

[1] *Fl. Ind.* i. (1855) 54, 57; and Introd. Essay, 8.

[2] Abu Mansur Mowafik ben Ali Alherui, *Liber Fundamentorum Pharmacologiæ*, i. (1830) 47. Seligmann's edition.

[3] Valgrisi edition, 1564. lib. ii. tract. 2. c. 8. (p. 347.)

[4] Ibn Baytar, Sontheimer's transl. i. (1840) 199.

[5] Clusius, *Exotica*, 289.

[6] *Pharm. Persica*, 1681. p. 358, also 17 and 319. The word *biach* is correctly given in Arabic characters, so that of its identity there can be no dispute.

[7] *Account of the Kingdom of Nepal*, Edin. 1819, 98.

[8] *Muse Helvétique d'Hist. Nat.* Berne, i. (1823) 160.

[9] Yet strange to say confused the plant with *A. Napellus*, an Indian form of which he figured as *A. ferox!*

[10] *Edinb. New Phil. Journ.* xlvii. (1849) 366, pl. 5.

[11] The first importation was in 1869, when ten bags containing 1000 lb., said to be part of a much larger quantity actually in London, were offered for sale by a drug-broker.

of simple tuberous roots of an elongated conical form, 3 to 4 inches long, and ½ to 1¾ inches in greatest diameter. Very often the roots have been broken in being dug up and are wanting in the lower extremity: some are nearly as broad at one end as at the other. They are mostly flattened and not quite cylindrical, often arched, much shrivelled chiefly in a longitudinal direction, and marked rather sparsely with the scars of rootlets. The aerial stem has been closely cut away, and is represented only by a few short scaly rudiments.[1]

The roots are of a blackish brown, the prominent portions being often whitened by friction. In their normal state they are white and farinaceous within, but as they are dried by fire-heat and often even scorched, their interior is generally horny, translucent, and extremely compact and hard. The largest root we have met with weighed 555 grains.

In the Indian bazaars, *Bish* is found in another form, the tuberous roots having been steeped in cow's urine to preserve them from insects.[2] These roots which in our specimen[3] are mostly plump and cylindrical, are flexible and moist when fresh, but become hard and brittle by keeping. They are externally of very dark colour, black and horny within, with an offensive odour resembling that of hyraceum or castor. Immersed in water, though only for a few moments, they afford a deep brown solution. Such a drug is wholly unfit for use in medicine, though not unsuitable perhaps for the poisoning of wild beasts, a purpose to which it is often applied in India.[4]

Microscopic Structure—Most of the roots fail to display any characteristic structure by reason of the heat to which they have been subjected. A living root sent to us from the Botanical Garden of Edinburgh exhibited the thin brownish layer which encloses the central part in *A. Napellus*, replaced by a zone of stone cells,—a feature discernible in the imported root.

Chemical Composition—The chemical constituents of Indian aconite have been noticed in the previous article.

Uses—The drug has been imported and used as a source of aconitine. It is commonly believed to be much more potent than the aconite root of Europe.

RADIX ACONITI HETEROPHYLLI.

Atís or Atees.

Botanical Origin—*Aconitum heterophyllum* Wallich, a plant of 1 to 3 feet high with a raceme of large flowers of a dull yellow veined with purple, or altogether blue, and reniform or cordate, obscurely

[1] There is a rude woodcut of the root in *Pharm. Journ.* i. (1871) 434.

[2] A specimen of ordinary *Bish* in my possession for two or three years became much infested by a minute and active insect of the genus *Psocus*.—D. H.

[3] Obligingly sent to me in 1867 by Messrs. Rogers and Co. of Bombay, who say it is the only kind there procurable.—D. H.

[4] According to Moodeen Sheriff (*Supplement to Pharm. of India*, pp. 25—32, 265) there are several kinds of aconite root found in the Indian bazaars, some of them highly poisonous, others innocuous. The first or poisonous aconites he groups under the head *Aconitum ferox*, while the second, of which there are three varieties mostly known by the Arabic name *Jadvár* (Persian *Zadvár*), he refers to undetermined species of *Aconitum*.

The surest and safest names in most parts of India for the poisonous aconite roots are *Bish* (Arabic); *Bis* (Persian); *Singyá-bis*, *Míthá-zahar*, *Bachhnág* (Hindustani); *Vashanávi* (Tamil); *Vasa-nábhi* (Malyalim).

5-lobed, radical leaves. It grows at elevations of 8000 to 13,000 feet in the temperate regions of the Western Himalaya, as in Simla, Kumaon and Kashmír.

History—We have not met with any ancient account of this drug, which however is stated by O'Shaughnessy[1] to have been long celebrated in Indian medicine as a tonic and aphrodisiac. It has recently attracted some attention on account of its powers as an antiperiodic in fevers, and has been extensively prescribed by European physicians in India.

Description—The tuberous roots of *A. heterophyllum* are ovoid, oblong, and downward-tapering or obconical; they vary in length from $\frac{1}{2}$ to $1\frac{1}{2}$ inches and in diameter from $\frac{3}{10}$ to $\frac{6}{10}$ of an inch, and weigh from 5 to 45 grains. They are of a light ash colour, wrinkled and marked with scars of rootlets, and have scaly rudiments of leaves at the summit. Internally they are pure white and farinaceous. A transverse section shows a homogeneous tissue with 4 to 7 yellowish vascular bundles. In a longitudinal section these bundles are seen to traverse the root from the scar of the stem to the opposite pointed end, here and there giving off a rootlet. The taste of the root is simply bitter with no acridity.

Microscopic Structure—The tissue is formed of large angular thin-walled cells loaded with starch which is either in the form of isolated or compound granules. The vascular bundles contain numerous spiroid vessels which seen in transverse section appear arranged so as to form about four rays. The outer coat of the root is made up of about six rows of compressed, tabular cells with faintly brownish walls.

Chemical Composition—The root contains a well-defined alkaloid of intensely bitter taste recently discovered by Broughton,[2] who assigns to it the formula $C^{46}H^{74}N^{2}O^{5}$, obtained from concurrent analyses of a platinum salt. The absence in the drug of aconitine has been proved by medical experience.[3]

Uses—The drug is stated to have proved a valuable remedy in intermittent and other paroxysmal fevers. In ordinary intermittents it may be given in powder in 20-grain doses. As a simple tonic the dose is 5 to 10 grains thrice a day.

Substitutes—The native name *Atís* is applied in India to several other drugs, one of which is an inert tasteless root commonly referred to *Asparagus sarmentosus* L. In Kunawar the tubers of *Aconitum Napellus* L. are dug up and eaten as a tonic, the name *atís* being applied to them as well as to those of *A. heterophyllum*.[4]

RADIX CIMICIFUGÆ.

Radix Actææ racemosæ; Black Snake-root, Black Cohosh, Bugbane.

Botanical Origin—*Cimicifuga racemosa* Elliott (*Actæa racemosa* L.), a perennial herb 3 to 8 feet high, abundant in rich woods in Canada and the United States, extending southward to Florida. It much

[1] *Bengal Dispensatory*, 1842. 167.
[2] Information communicated by Mr. B. in private letter, 10 Oct. 1873.
[3] *Pharm. of India*, 1868. 4. 434.
[4] Hooker and Thomson (on the authority of Munro) *Flor. Ind.* 1855. 58.

resembles *Actæa spicata* L., a plant widely spread over the northern parts of Europe, Asia, and America, occurring also in Britain; but it differs in having an elongated raceme of 3 to 8 inches in length and dry dehiscent capsules. *A. spicata* has a short raceme and juicy berries, usually red.

History—The plant was first made known by Plukenet in 1696 as *Christophoriana Canadensis racemosa.* It was recommended in 1743 by Colden[1] and named in 1749 by Linnæus in his *Materia Medica* as *Actæa racemis longissimis.* In 1823 it was introduced into medical practice in America by Garden; it began to be used in England about the year 1860.[2]

Description—The drug consists of a very short, knotty, branching rhizome, $\frac{1}{2}$ an inch or more thick, having, in one direction, the remains of several stout aerial stems, and in the other, numerous brittle, wiry roots, $\frac{1}{20}$ to $\frac{1}{10}$ of an inch in diameter, emitting rootlets still smaller. The rhizome is of somewhat flattened cylindrical form, distinctly marked at intervals with the scars of fallen leaves. A transverse section exhibits in the centre a horny whitish pith, round which are a number of rather coarse, irregular woody rays, and outside them a hard, thickish bark. The larger roots when broken display a thick cortical layer, the space within which contains converging wedges of open woody tissue 3 to 5 in number forming a star or cross,—a beautiful and characteristic structure easily observed with a lens. The drug is of a dark blackish brown; it has a bitter, rather acrid and astringent taste, and a heavy narcotic smell.

Microscopic Structure—The most striking character is afforded by the rootlets, which on a transverse section display a central woody column, traversed usually by 4 wide medullary rays and often enclosing a pith. The woody column is surrounded by a parenchymatous layer separated from the cortical portion by one row of densely packed small cells constituting a boundary analogous to the nucleus-sheath (*kernscheide*) met with in many roots of monocotyledons, as for instance in sarsaparilla. The parenchyme of cimicifuga root contains small starch granules. The structure of the drug is, on the whole, the same as that of the closely allied European *Actæa spicata* L.

Chemical Composition—Tilghmann[3] in 1834 analysed the drug, obtaining from it gum, sugar, resin, starch and tannic acid, but no peculiar principle.

Conard[4] extracted from it a neutral crystalline substance of intensely acrid taste, soluble in dilute alcohol, chloroform, or ether, but not in benzol, oil of turpentine, or bisulphide of carbon. The composition of this body has not been ascertained. The same chemist showed the drug not to afford a volatile principle, even in its fresh state.

The American practitioners called *Eclectics* prepare with *Black Snakeroot* in the same manner as they prepare podophyllin, an impure resin which they term *Cimicifugin* or *Macrotin.* The drug yields according to Parrish, $3\frac{3}{4}$ per cent of this substance, which is sold in the form of scales or as a dark brown powder.

[1] *Acta Soc. Reg. Scient. Upsal.* 1743. 131.
[2] Bentley, *Pharm. Journ.* ii. (1861) 460.
[3] Quoted by Bentley.
[4] *Am. Journ. of Pharm.* xliii. (1871) 151; *Pharm. Journ.* April 29, 1871. 866.

Uses—Cimicifuga usually prescribed in the form of tincture (called *Tinctura Actææ racemosæ*) has been employed chiefly in rheumatic affections. It is also used in dropsy, the early stages of phthisis, and in chronic bronchial disease. A strong tincture has been lately recommended in America as an external application for reducing inflammation.[1]

MAGNOLIACEÆ (tribe *Wintereæ*).

CORTEX WINTERANUS.

Cortex Winteri, Cortex Magellanicus; Winter's Bark, Winter's Cinnamon; F. *Ecorce de Winter;* G. *Wintersrinde, Magellanischer Zimmt.*

Botanical Origin—*Drimys*[2] *Winteri* Forster, a tree distributed throughout the American continent from Mexico to Cape Horn. It presents considerable variation in form and size of leaf and flower in the different countries in which it occurs, on which account it has received from botanists several distinct specific names. Hooker[3] has reduced these species to a single type, a course in which he has been followed by Eichler in his recent monograph of the small order *Winteraceæ*.[4]

History—In 1577 Captain Drake, afterwards better known as Sir Francis Drake, having obtained from Queen Elizabeth a commission to conduct a squadron to the South Seas, set sail from Plymouth with five ships; and having abandoned two of his smaller vessels, passed into the Pacific Ocean by the Straits of Magellan in the autumn of the following year. But on the 7th September, 1578, there arose a dreadful storm, which dispersed the little fleet. Drake's ship, the *Pelican*, was driven southward, the *Elizabeth*, under the command of Captain Winter, repassed the Straits and returned to England, while the third vessel, the *Marigold*, was heard of no more.

Winter remained three weeks in the Straits of Magellan to recover the health of his crew, during which period, according to Clusius (the fact is not mentioned in Hakluyt's account of the voyage), he collected a certain aromatic bark, of which, having removed the acridity by steeping it in honey, he made use as a spice and medicine for scurvy during his homeward voyage.

A specimen of this bark having been presented to Clusius, he gave it the name of *Cortex Winteranus*, and figured and described it in his *Libri Exoticorum*, published in 1605. He afterwards received a specimen with wood attached, which had been collected by the Dutch navigator Sebald de Weerdt.

Van Noort, another well-known Dutch navigator, who visited the Straits of Magellan in 1600, mentions cutting wood at Port Famine to

[1] *Yearbook of Pharmacy*, 1872. 385.
[2] From δριμύς, *acrid, biting.*
[3] *Flora Antarctica*, ii. (1847) 229.
[4] Martius, *Flor. Bras.* fasc. 38 (1864) 134. Eichler however admits five principal varieties, viz. α. *Magellanica*; β. *Chilensis*; γ. *Granatensis*; δ. *revoluta*; ε. *angustifolia*.

make a boat, and that the bark of the trees was hot and biting like pepper. It is stated by Murray that he also brought the bark to Europe.

But although the Straits of Magellan were several times visited about this period, it is certain that no regular communication between that remote region and Europe existed either then or subsequently; and we may reasonably conclude that Winter's Bark became a drug of great rarity, and known to but few persons. It thus happened that, notwithstanding most obvious differences, the Canella alba of the West Indies, and another bark of which we shall speak further on, having been found to possess the pungency of Winter's Bark, were (owing to the scarcity of the latter) substituted for it, until at length the peculiar characters of the original drug came to be entirely forgotten.

The tree was figured by Sloane in 1693, from a specimen (still extant) brought from Magellan's Straits by Handisyd, a ship's surgeon, who had experienced its utility in treating scurvy.

Feuillée[1] a French botanist, found the Winter's Bark-tree in Chili (1709–11), and figured it as *Boigue cinnamomifera*. It was, however, Forster,[2] the botanist of Cook's second expedition round the world, who first described the tree accurately, and named it *Drimys Winteri*. He met with it in 1773 in Magellan's Straits, and on the eastern coasts of Tierra del Fuego, where it grows abundantly, forming an evergreen tree of 40 feet, while on the western shores it is but a shrub of 10 feet high. Specimens have been collected in these and adjacent localities by many subsequent botanists, among others by Dr. J. D. Hooker, who states that about Cape Horn the tree occurs from the sea-level to an elevation of 1000 feet.

Although the bark of *Drimys* was never imported as an article of trade from Magellan's Straits, it has in recent times been occasionally brought into the market from other parts of South America, where it is in very general use. Yet so little are drug dealers acquainted with it, that its true name and origin have seldom been recognized.[3]

Description—We have examined specimens of true Winter's Bark from the Straits of Magellan, Chili, Peru, New Granada, and Mexico, and find in each the same general characters. The bark is in quills or channelled pieces, often crooked, twisted or bent backwards, generally only a few inches in length. It is mostly extremely thick ($\frac{1}{10}$ to $\frac{3}{10}$ of an inch) and appears to have shrunk very much in drying, bark a quarter of an inch thick having sometimes rolled itself into a tube only three times as much in external diameter. Young pieces have an ashy-grey suberous coat beset with lichens. In older bark, the outer coat is sometimes whitish and silvery, but more often of a dark rusty brown, which is the colour of the internal substance, as well as of the surface next the wood. The inner side of the bark is strongly characterized by very rough striæ, or, as seen under a lens, by small short and sharp longitudinal ridges, with occasional fissures indicative of great contraction of the inner layer in drying. In a piece broken or cut transversely, it is easy to perceive that the ridges in question are the ends of

[1] *Journ. des observations physiques*, &c. iv. 1714. 10, pl. 6.

[2] *Characteres Generum Plantarum*, 1775. 42.

[3] We have seen it offered in a drug sale at one time as "*Pepper Bark*," at another as "*Cinchona*." Even Mutis thought it a Cinchona, and called it "*Kinkina urens*"!

rays of white liber which diverge towards the circumference in radiate order, a dark rusty parenchyme intervening between them. No such feature is ever observable in either *Canella* or *Cinnamodendron.*

Winter's Bark has a short, almost earthy fracture, an intolerably pungent burning taste, and an odour which can only be described as terebinthinous. When fresh its smell may be more agreeable.

Microscopic Structure—In full-grown specimens the most striking fact is the predominance of sclerenchymatous cells. The tissue moreover contains numerous large oil-ducts, chiefly in the inner portion of the large medullary rays. A fibrous structure of the inner part of the bark is observable only in the youngest specimens.[1] Very small starch granules are met with in the drug, yet less numerous than in canella. The tissue of the former assumes a blackish blue colour on addition of perchloride of iron.

The wood of *Drimys* consists of dotted prosenchyme, traversed by medullary rays, the cells of which are punctuated and considerably larger than in *Coniferæ.*

Chemical Composition—No satisfactory chemical examination has been made of true Winter's Bark. Its chief constituents, as already pointed out, are tannic matters and essential oil, probably also a resin. In a cold aqueous infusion, a considerable amount of mucilage is indicated by neutral acetate of lead. On addition of potash it yields a dark somewhat violet liquid. Canella alba is but little altered by the same treatment. By reason of its astringency the bark is used in Chili for tanning.[2]

Uses—Winter's Bark is a stimulating tonic and antiscorbutic, now almost obsolete in Europe. It is much used in Brazil and other parts of South America as a remedy in diarrhœa and gastric debility.

Substitute—*False Winter's Bark*—We have shown that the bark of *Drimys* or True Winter's Bark has been confounded with the pungent bark of *Canella alba* L., and with an allied bark, also the produce of Jamaica. The latter is that of *Cinnamodendron corticosum* Miers,[3] a tree growing in the higher mountain woods of St. Thomas-in-the-Vale and St. John, but not observed in any other of the West Indian islands than Jamaica. It was probably vaguely known to Sloane when he described the "*Wild Cinamon tree, commonly, but falsely, called* Cortex Winteranus," which, he says, has leaves resembling those of *Lauro-cerasus;* though the tree he figures is certainly *Canella alba.*[4] Long[5] in 1774, speaks of *Wild Cinnamon, Canella alba,* or *Bastard Cortex Winteranus,* saying that it is used by most apothecaries instead of the true *Cortex Winteranus.*

It is probable that both writers really had in view *Cinnamodendron,* the bark of which has been known and used as *Winter's Bark,* both in England and on the continent from an early period up to the present time.[6] It is the bark figured as *Cortex Winteranus* by Goebel and Kunze[7]

[1] The structure of Winter's Bark is beautifully figured by Eichler, loc. cit. tab. 32..

[2] Perez-Rosales, *Essai sur le Chili,* 1857. 112.

[3] *Annals of Nat. I* 1858; also *Miers' Contributio* .. 121, pl. 24.

[4] *Phil. Trans.* . 465

[5] *Hist. of Jamaica,* Lond. iii. (1774) 705—also i. 495.

[6] It is so labelled in the Museum of the Pharmaceutical Society, 28th April, 1873.

[7] *Pharm. Waarenkunde,* 1827–29. i. taf. 3. fig. 7.

and described by Mérat and De Lens,[1] Pereira, and other writers of repute. Guibourt indeed pointed out in 1850 its great dissimilarity to the bark of *Drimys* and questioned if it could be derived from that genus.

It is a strange fact that the tree should have been confounded with *Canella alba* L., differing from it as it does in the most obvious manner, not only in form of leaf, but in having the flowers *axillary*, whereas those of *C. alba* are *terminal*. Although *Cinnamodendron corticosum* is a tree sometimes as much as 90 feet high[2] and must have been well known in Jamaica for more than a century, yet it had no botanical name until 1858 when it was described by Miers[3] and referred to the small genus *Cinnamodendron* which is closely allied to *Canella*.

The bark of *Cinnamodendron* has the general structure of Canella alba. There is the same thin corky outer coat (which is *not* removed) dotted with round scars, the same form of quills and fracture. But the tint is different, being more or less of a ferruginous brown. The inner surface which is a little more fibrous than in canella, varies in colour, being yellowish, brown, or of a deep chocolate. The bark is violently pungent but not bitter, and has a very agreeable cinnamon-like odour.

In *microscopic structure* it approaches very close to canella; yet the thick-walled cells of the latter exist to a much larger extent and are here seen to belong to the suberous tissue. The medullary rays are loaded with oxalate of calcium.

Cinnamodendron bark has not been analysed. Its decoction is blackened by a persalt of iron whereby it may be distinguished from Canella alba; and is coloured intense purplish brown by iodine, which is not the case with a decoction of true Winter's Bark.

FRUCTUS ANISI STELLATI.

Semen Badiani[4]; *Star-Anise*; F. *Badiane, Anis étoilé*; G. *Sternanis*.

Botanical Origin—*Illicium anisatum* Loureiro (*I. religiosum* Sieb.). A small tree, 20 to 25 feet high, native of the south-western provinces of China; introduced at an early period into Japan by the Buddhists and planted about their temples.

Kämpfer in his travels in Japan towards the end of the 17th century discovered a tree called *Somo* or *Skimmi*[5] which subsequent authors assumed to be the source of the drug Star-anise. The tree was also found in Japan by Thunberg[6] who remarked that its capsules are not so aromatic as those found in trade. Von Siebold in 1825 noticed the same fact, in consequence of which he regarded the tree as distinct from that of Loureiro, naming it *Illicium Japonicum*, a name he afterwards changed to *I. religiosum*. Baillon who has recently investigated the subject[7] while admitting certain differences between the fruits of the Chinese and

[1] As shown by De Lens' own specimen kindly given to one of us by Dr. J. Léon Soubeiran. There are specimens of the same bark about a century old marked *Cortex Winteranus verus* in Dr. Burges's cabinet of drugs belonging to the Royal College of Physicians.

[2] Grisebach calls it a low shrubby tree, 10—15 feet high. Mr. N. Wilson, late of the Bath Botanic Garden, Jamaica, has informed me it grows to be 40—45 in height, but that he has seen a specimen 90 feet high. (Letter 22 May, 1862.)—D. H.

[3] Loc. cit.

[4] From the Arabic *Bádiyán*, *anise*.

[5] *Amœnitates*, 1712. 808.

[6] *Flora Japonica*, 1784. 235.

[7] *Adansonia*, viii. 9; *Hist. des Plantes, Magnoliacées*, 1868. 154.

Japanese trees, holds them to constitute but one species, and the same view is taken by Miquel.

The Star-anise of commerce is produced in the high mountains of Yunnan in South-western China where the tree, which attains a height of 12 to 15 feet, grows in abundance.[1] The fruits of the Japanese variety of the tree are not collected, and the Chinese drug alone is in use even in Japan.

History—Notwithstanding its striking appearance, there is no evidence that star-anise found its way to Europe like other Eastern spices during the middle ages. Concerning its ancient use in China, the only fact we have found recorded is, that during the Sung dynasty, A.D. 970—1127, star-anise was levied as tribute in the southern part of Kien-chow, now Yen-ping-fu, in Fokien.[2]

Star-anise was brought to England from the Philippines by the voyager Candish, about A.D. 1588. Clusius obtained it in London from the apothecary Morgan and the druggist Garet, and described it in 1601.[3] The drug appears to have been rare in the time of Pomet, who states (1694) that the Dutch use it to flavour their beverages of tea and "sorbec."[4] In those times it was brought to Europe by way of Russia, and was thence called *Cardamomum Siberiense*, or *Anis de Sibéric*.

Description—The fruit of *Illicium anisatum* is formed of 8 one-seeded carpels, originally upright, but afterwards spread into a radiate whorl and united in a single row round a short central column which proceeds from an oblique pedicel. When ripe they are woody and split longitudinally at the upturned ventral suture, so that the shining seed becomes visible. This seed, which is elliptical and somewhat flattened, stands erect in the carpel; it is truncated on the side adjoining the central column, and is there attached by an obliquely-rising funicle. The upper edge of the seed is keeled, the lower rounded. The boat-shaped carpels, to the number of 8, are attached to the column through their whole height, but adhere to each other only slightly at the base; the upper or split side of each carpel occupies a nearly horizontal position. The carpels are irregularly wrinkled, especially below, and are more or less beaked at the apex; their colour is a rusty brown. Internally they are of a brighter colour, smooth, and with a cavity in the lower half corresponding to the shape of the seed. The cavity is formed of a separate wall, ½ millim. thick, which, as well as the testa of the seed, distinctly exhibits a radiate structure. The small embryo lies next the hilum in the soft albumen, which is covered by a dark brown endopleura. The seed, which is not aromatic, amounts to about one-fifth of the entire weight of the fruit.

Star-anise has an agreeable aromatic taste and smell, more resembling fennel than anise, on which account it was at first designated *Fœniculum Sinense*.[5] When pulverised it has a sub-acid after-taste.

Microscopic Structure—The carpels consist of an external, loose, dark-brown layer and a thick inner wall, separated by fibro-vascular bundles. The outer layer exhibits numerous large cells, containing pale

[1] Thorel, *Notes médicales du voyage d'exploration du Mékong et de Cochinchine*, Paris, 1870. 31.

[2] Bretschneider [Foochow] *Chinese Recorder*, Jan. 1871.

[3] *Rarior. Plant. Hist.* 202.

[4] *Hist. des Drog.* pt. i. liv. i. 43.

[5] Redi, *Experimenta*, 1675, p. 172.

yellow volatile oil. The inner wall of the carpels consists of woody prosenchyme in those parts which are exterior to the seed-cavity, and especially in the shining walls laid bare by the splitting of the ventral suture. The inner surface of the carpel is entirely composed of sclerenchyme. A totally different structure is exhibited by this stony shell where it lines the cavity occupied by the seed. Here it is composed of a single row of cells, consisting of straight tubes exactly parallel to one another, more than 500 mkm. long and 70 mkm. in diameter, placed vertically to the seed cavity; their porous walls, marked with fine spiral striations, display splendid colours in polarized light. The seed contains albumin and drops of fat. Starch is wanting in star-anise, except a little in the fruit stalk.

Chemical Composition—The volatile oil amounts to 4 or 5 per cent. Its composition is that of the oils of fennel or anise; it usually solidifies below 2° C. The oils of anise and star-anise, as distilled by one of us, possess no striking optical differences, both deviating very little to the left. We are unable to give characters by which they can be discriminated, although they are distinguished by dealers.

Star-anise is rich in sugar, which seems to be cane-sugar inasmuch as it does not reduce alkaline cupric tartrate. An aqueous extract of the fruit assumes, on addition of alcohol, the form of a clear mucilaginous jelly, of which pectin is probably a constituent. The seeds contain a large quantity of fixed oil.

Commerce—Star-anise is shipped to Europe and India from China. In 1872 Shanghai imported, mostly by way of Hongkong (but from what previous port we have failed to trace), 5273 peculs (703,066 ℔), a large proportion of which was re-shipped to other ports of China.[1] The same drug, under the name of *Bádiyáne-khatái* (i.e. *Chinese anise*), is carried by inland trade from China to Yarkand and thence to India where it is much esteemed.

Uses—Star-anise is employed to flavour spirits, the principal consumption being in Germany, France, and Italy. It is not used in medicine, at least in England, except in the form of essential oil, which is often sold for oil of aniseed.

MENISPERMACEÆ.

RADIX CALUMBÆ.

Radix Columbo; Calumba or Colombo Root; F. *Racine de Colombo;* G. *Kalumbawurzel, Columbowurzel.*

Botanical Origin—*Jateorhiza palmata* Miers[2] a diœcious perennial plant with large fleshy roots and herbaceous annual stems, climbing

[1] *Returns of Trade at the Treaty Ports in China for* 1872, p. 4—8.

[2] Synonyms—*Menispermum palmatum* Lamarck, *Cocculus palmatus* DC, *Menispermum Columba* Roxb., *Jateorhiza Calumba* Miers, *J. Miersii* Oliv., *Chasmanthera Columba* Baillon. As we thus suppress a species admitted in recent works, it is necessary to give the following explanation. *Menispermum palmatum* of Lamarck, first described in the *Encyclopédie méthodique* in 1797 (iv. 99), was divided by Miers into two species, *Jateorhiza palmata* and *J. Calumba*. Oliver in his *Flora of Tropical Africa*, i. (1868) 42, accepted the view taken by Miers, but to avoid confusion abolished the specific name *palmata*, substituting for it that of *Miersii*. At the same time he noticed the close relationship of the two species, and suggested that further investigation might [warrant

ıshes and to the tops of lofty trees. The leaves are of large size long stalks, palmate-lobed and membranous. The male flowers racemose panicles a foot or more in length, setose-hispid at least r lower part, or nearly glabrous. The whole plant is more or less with spreading setæ and glandular hairs.

s indigenous to the forests of Eastern Africa between Ibo or Oibo, ıst northerly of the Portuguese settlements (lat. 12° 20′ S.), and ıks of the Zambesi, a strip of coast which includes the towns of bique and Quilimane. Kirk found it (1860) in abundance at ıga, among the hills near Morambala, at Kebrabasa and near localities all in the region of the Zambesi. Peters[1] states that islands of Ibo and Mozambique the plant is cultivated. In the erbarium is a specimen from the interior of Madagascar.

plant was introduced into Mauritius a century ago in the time French governor Le Poivre, but seems to have been lost, for after ıttempts it was again introduced in 1825 by living specimens d from Ibo by Captain Owen.[2] It still thrives there in the al Garden of Pamplemousses.

was taken from Mozambique to India in 1805 and afterwards ted by Roxburgh in the Calcutta Garden, where however it has ased to exist.

ıtory—The root is held in high esteem among the natives of Africa who call it *Kalumb*, and use it for the cure of dysentery a general remedy for almost any disorder.

ras brought to Europe by the Portuguese in the 17th century, and noticed briefly in 1671 by Francesco Redi an Italian physician zzo, who speaks of it[3] as an antidote to poison deserving

further attention was paid to the drug for nearly a century, when l[4] in 1773 re-introduced it as "*a medicine of considerable efficacy t so generally known in practice as it deserves to be.*" From this it began to come into general use. J. Gurney Bevan, a London t, writing to a correspondent in 1777 alludes to it as—"an article much dealt in and subject to great fluctuation." It was in fact period extremely dear, and in Mr. Bevan's stock-books is valued and 1777 at 30*s.* per lb., in 1780 at 28*s.*, 1781 at 64*s.*, 1782 at 83 at 6*s.* Calumba was admitted to the *London Pharmacopœia* .

their union. The characters sup- distinguish them *inter se* are briefly n *J. palmata*, the lobes at the base eaf *overlap*, and the male inflor- is nearly glabrous; while in *J.* , the basal lobes are rounded, but *erlap*, and the male inflorescence is pid ("*sparsely pilose*" Miers). On xamination of a large number of s, including those of Berry from and others from Mauritius, Mada- nd the Zambesi, together with the of Telfair and Roxburgh, and the l figures and descriptions, I am l that the characters in question portant and do not warrant the nent of two species. In this view I have the support of Mr. Horne of Mauritius, who at my request has made careful observations on the living plant and found that both forms of leaf occur on the same stem.—D. H.

[1] *Reise nach Mossambique*, Botanik i. (1862) 172.

[2] Hooker, *Bot. Mag.* lvii. (1830) tabb. 2970–71.

[3] "Sono ancora da farsi nuove esperienze intorno alla *radice di Calumbe*, creduta un grandissimo alessifarmaco."—*Esperienze intorno a diverse cose naturali*, etc. Firenze, 1671. 125.

[4] *Essays, Medical and Experimental*, Lond. ii. (1773) 3.

Collection—As to the collection and preparation of the drug for the market, the only account we possess is that obtained by Dr. Berry,[1] which states that the roots are dug up in the month of March, which is the dry season, cut into slices and dried in the shade.

Description—The calumba plant produces great fusiform fleshy roots growing several together from a short head. Some fresh specimens sent to one of us (H.) from the Botanic Garden, Mauritius, in 1866, and others from that of Trinidad in 1868, were portions of cylindrical roots, 3 to 4 inches in diameter, externally rough and brown, and internally firm, fleshy, and of a brilliant yellow. When sliced transversely, and dried by a gentle heat, these roots exactly resemble imported calumba except for being much fresher and brighter.

The calumba of commerce consists of irregular flattish pieces of a circular or oval outline, 1 to 2 inches or more in diameter, and $\frac{1}{8}$ to $\frac{1}{4}$ an inch thick. In drying, the central portion contracts more than the exterior: hence the pieces are thinnest in the middle. The outer edge is invested with a brown wrinkled layer which covers a corky bark about $\frac{3}{8}$ of an inch thick, surrounding a pithless internal substance, from which it is separated by a fine dark shaded line. The pieces are light and of a corky texture, easily breaking with a mealy fracture. Their colour is a dull greenish yellow, brighter when the outer surface is shaved off with a knife.[2] The drug has a weak musty odour and a rather nauseous bitter taste. It often arrives much perforated by insects, but seems not liable to such depredations here.

Microscopic Structure—On a transverse section the root exhibits a circle of radiate vascular bundles only in the layer immediately connected with the cambial zone; they project much less distinctly into the cortical part. The tissue of the whole root, except the cork and vascular bundles, is made up of large parenchymatous cells. In the outer part of the bark, some of them have their yellow walls thickened and are loaded with fine crystals of oxalate of calcium, whilst all the other cells contain very large starch granules, attaining as much as 90 mkm. The short fracture of the root is due to the absence of a proper ligneous or liber tissue.

Chemical Composition—The bitter taste of calumba, and probably likewise its medicinal properties, are due to three distinct substances, *Columbin*, *Berberine*, and *Columbic Acid*.

Columbin or *Columba-Bitter* was discovered by Wittstock in 1830. It is a neutral bitter principle, crystallizing in colourless rhombic prisms, slightly soluble in cold alcohol or ether, but dissolving more freely in those liquids when boiling. It is soluble in aqueous alkalis and in acetic acid.

The presence of *Berberine* in calumba was ascertained in 1848 by Bödeker, who showed that the yellow cell-walls of the root owe their colour to it and (as we may add) to *Columbic Acid*, another substance discovered by the same chemist in the following year. Columbic acid is yellow, amorphous, nearly insoluble in cold water, but dissolving in alcohol and in alkaline solutions. It tastes somewhat less bitter than

[1] *Asiatick Researches*, x. (1808) 385; Ainslie, *Mat. Med. of Hindoostan*, 298.

[2] Wholesale druggists sometimes wash the drug to improve its colour.

columbin. Bödeker surmises that it may exist in combination with the berberine.

Bodeker has pointed out a connexion between the three bitter principles of calumba. If we suppose a molecule of ammonia, NH^3, to be added to columbin $C^{42}H^{44}O^{14}$, the complex molecule thence resulting will contain the elements of berberine $C^{20}H^{17}NO^4$, columbic acid $C^{22}H^{24}O^7$, and water 3 H^2O.

Among the more usual constituents of plants, calumba contains (in addition to starch) pectin, gum, and nitrate of potassium, but no tannic acid. It yields when incinerated 6 per cent. of ash.

Commerce—Calumba root is shipped to Europe from Zanzibar, and from Bombay and other Indian ports.

Uses—It is much employed as a mild tonic, chiefly in the form of tincture or of aqueous infusion.

PAREIRA BRAVA.

Radix Pareiræ ; Pareira Brava[1] ; F. *Racine de Butua ou de Pareira-Brava ;* G. *Grieswurzel.*

Botanical Origin—*Chondodendron tomentosum* Ruiz et Pav. (non Eichler) (*Cocculus Chondodendron* DC., *Botryopsis platyphylla* Miers[2]). —It is a lofty climbing shrub with long woody stems, and leaves as much as a foot in length. The latter are of variable form but mostly broadly ovate, rounded or pointed at the extremity, slightly cordate at the base, and having long petioles. They are smooth on the upper side; on the under covered between the veins with a fine close tomentum of an ashy hue. The flowers are unisexual, racemose, minute, produced either from the young shoots or from the woody stems. The fruits are ¾ of an inch long, oval, black and much resembling grapes in form and arrangement.[3]

The plant grows in Peru and Brazil,—in the latter country in the neighbourhood of Rio de Janeiro, where it occurs in some abundance on the range of hills separating the Copacabana from the basin of the Rio de Janeiro. It is also found about San Sebastian further south.

History—The Portuguese missionaries who visited Brazil in the 17th century became acquainted with a root known to the natives as *Abutua* or *Butua*, which was regarded as possessing great virtues. As the plant affording it was a tall climbing shrub with large, simple, long-stalked leaves, and bore bunches of oval berries resembling grapes, the Portuguese gave it the name of *Parreira brava* or Wild Vine.

The root was brought to Lisbon where its reputed medicinal powers attracted the notice of many persons, and among others of Michel Amelot, ambassador of Louis XIV., who took back some of it when he returned to Paris in 1688. Specimens of the drug also reached the botanist Tournefort, and one presented by him to Pomet was figured and

[1] From the Portuguese *parreira*, signifying a vine that grows against a wall (in French *treille*), and *brava*, wild.

[2] As figured by Eichler in Martius' *Flor. Bras.* fasc. 38. tab. 48. The *Cissampelos Abutua* of Vellozo's *Flora Fluminensis*, tom. x. tab. 140 appears to us the same plant.

[3] See *Pharm. Journ.* Aug. 2, 1873. 83; *Am. Journ. of Pharm.* Oct. 1, 1873. fig. 3.

described by the latter in 1694.[1] The drug was again brought to Paris by Louis-Raulin Rouillé, the successor to Amelot at Lisbon, together with a memoir detailing its numerous virtues.

Specimens obtained in Brazil by a naval officer named De la Mare in the early part of the last century, were laid before the French Academy, which body requested a report upon them from Geoffroy, professor of medicine and pharmacy in the College of France, who was already somewhat acquainted with the new medicine. He reported many favourable trials in cases of inflammations of the bladder and suppression of urine.[2] The drug was a favourite remedy of Jean-Claude-Adrien Helvetius,[3] physician to Louis XIV. and Louis XV., who administered it for years with great success.

Both Geoffroy and Helvetius were in frequent correspondence with Sloane[4] who received from the former as well as from other sources specimens of Pareira Brava, which are still in the British Museum and have enabled us fully to identify the drug as the root of *Chondodendron tomentosum.*

Several other plants of the order *Menispermaceæ* have stems or roots employed in South America in the same manner as *Chondodendron.* Pomet had heard of two varieties of Pareira Brava, and two were known to Geoffroy.[5] Lochner of Nuremberg who published a treatise on Pareira Brava in 1719[6] brought forward a plant of Eastern Africa figured in 1675 by Zanoni,[7] and supposed to be the mother-plant of the drug. A species of *Cissampelos* called by the Portuguese in Brazil *Caapeba, Cipó de Cobras* or *Herva de Nossa Senhora* described by Piso in 1648,[8] afterwards became associated with Pareira Brava on account of similarity of properties.

Thus was introduced a confusion which we may say was *consolidated* when Linnæus in 1753,[9] founded a species as *Cissampelos Pareira,* citing it as the source of Pareira Brava,—a confusion which has lasted for more than a hundred years. This plant is very distinct from that yielding true Pareira Brava, and though its roots and stems are used medicinally in the West Indies,[10] there is nothing to prove that they were ever an object of export to Europe.

As Pareira Brava failed to realize the extravagant pretensions claimed for it, it gradually fell out of use[11] and the characters of the true drug became forgotten. This at least seems to be the explanation of the fact that for many years past the Pareira Brava found in the shops and supposed to be genuine is a substance very diverse from the original drug,—albeit not devoid of medicinal properties. More recently even this has become scarce and an inert Pareira Brava has been almost the sole

[1] *Hist. des Drog.*, Paris, 1694, part i., livre 2. cap. 14.

[2] *Hist. de l'Acad. roy. des Sciences*, année 1710. 56.

[3] *Traité des Maladies les plus fréquentes et des remèdes spécifiques pour les guérir*, Paris, 1703. 98.

[4] In the volumes of Sloane MSS. No. 4045 and 3322 contained in the British Museum, are a great many letters to Sloane from Etienne-François Geoffroy and from his younger brother Claude-Joseph, dating 1699 to 1744.

[5] *Tract. de Mat. Med.* ii. (1741) 21—25.

[6] *Schediasma de Parreira Brava*, 1719. (ed. 2. auctior).

[7] *Istoria Botanica*, 1675. 59. fig. 22.

[8] *Medicina Brasiliensis*, 1648. 94.

[9] *Species Plantarum*, Holmiæ, 1753; see also *Mat. Med.* 1749. No. 459.

[10] Lunan, *Hort. Jamaic.* ii. (1814) 254; Descourtilz, *Flor. méd. des Antilles*, iii. (1827) 231.

[11] Thus it was omitted from the London pharmacopœias of 1809 and 1824, and from many editions of the *Edinburgh Dispensatory.*

kind obtainable. The true drug has however still at times appeared in the European market, and attention having been lately directed to it,[1] we may hope that it will arrive in a regular manner.

The re-introduction of Pareira Brava into medical practice is due (so far as Great Britain is concerned) to Brodie[2] who recommended it in 1828 for inflammation of the bladder.

Description—True Pareira Brava as derived from *Chondodendron tomentosum* is a long, branching, woody root, attaining 2 inches or more in diameter, but usually met with much smaller and dividing into rootlets no thicker than a quill or even than a horse-hair. It is remarkably tortuous or serpentine and marked with transverse ridges as well as with constrictions and cracks more or less conspicuous; besides which the surface is strongly wrinkled longitudinally. The bark is of a dark blackish brown or even quite black when free from earth, and disposed to exfoliate. The root breaks with a coarse fibrous fracture; the inner substance is of a light yellowish brown,—sometimes of a dull greenish brown.

Roots of about an inch in diameter cut transversely exhibit a central column 0·2 to 0·4 of an inch in diameter, composed of 10 to 20 converging wedges of large-pored woody tissue with 3 or 4 zones divided from each other by a wavy light-coloured line. Crossing these zones are wedge-shaped woody rays, often rather sparsely and irregularly distributed. The interradial substance has a close, resinous, waxy appearance.

The root though hard is easily shaved with a knife, some pieces giving the impression when cut of a waxy, rather than of a woody and fibrous substance. The taste is bitter, well-marked but not persistent. The drug has no particular odour. Its aqueous decoction is turned inky bluish-black by tincture of iodine.

The aerial stems especially differ by enclosing a small but well-defined pith.

Microscopic Structure—The most interesting character consists in the arrangement rather than in the peculiarity of the tissues composing this drug. The wavy light-coloured lines already mentioned are built up partly of sclerenchymatous cells. The other portions of the parenchyme are loaded with large starch granules, which are much less abundant in the stem.

Chemical Composition—From the examination of this drug made by one of us in 1869,[3] it was shown that the bitter principle is the same as that discovered in 1839 by Wiggers in the drug hereafter described as *Common False Pareira Brava*, and named by him *Pelosine*. It was further pointed out that this body possesses the chemical properties of the *Bibirine* of Greenheart bark and of the *Buxine* obtained by Walz from the bark of *Buxus sempervirens* L. It was also obtained on the same occasion (1869) from the stems and roots of *Cissampelos Pareira* L. collected in Jamaica; but from both drugs in the very small proportion of about ½ per cent.

Whether to *Buxine* (for by this name rather than *Pelosine* it should

[1] Hanbury in *Pharm. Journ.* Aug. 2—9, 1873, pp. 81 and 102.

[2] *Lond. Med. Gazette*, Feb. 16, 1828; Brodie, *Lectures on Diseases of the Urinary Organs*, ed. 3. 1842. 108, 138.

[3] *Neues Jahrb. f. Pharm.* xxxi. (1869) 257; *Pharm. Journ.* xi. (1870) 192.

be designated) is due the medicinal power of the drug may well be doubted. No further chemical examination of true Pareira Brava has been made.

Uses—The medicine is prescribed in chronic catarrhal affections of the bladder and in calculus. From its extensive use in Brazil[1] it seems deserving of trial in other complaints. Helvetius used to give it in substance, which in 5-grain doses was taken in infusion made with boiling water from the powdered root and not strained.

Substitutes—We have already pointed out how the name *Pareira Brava* has been applied to several other drugs than that described in the foregoing pages. We shall now briefly notice the more important

1. *Stems and roots of Cissampelos Pareira* L.—Owing to the difficulty of obtaining good Pareira Brava in the London market, the firm of which one of us was formerly a member (Messrs. Allen and Hanburys, Plough Court, Lombard Street) caused to be collected in Jamaica under the superintendence of Mr. N. Wilson, of the Bath Botanical Gardens, the stems and root of *Cissampelos Pareira* L., of which it imported in 1866–67–68 about 300lb. It was found impracticable to obtain the root *per se;* and the greater bulk of the drug consisted of long cylindrical stems many of which had been decumbent and had thrown out rootlets at the joints. They had very much the aspect of the climbing stems of *Clematis Vitalba* L., and varied from the thickness of a quill to that of the forefinger, seldom attaining the diameter of an inch. The stems have a light brown bark marked longitudinally with shallow furrows and wrinkles, which sometimes take a spiral direction. Knots one to three feet apart, sometimes throwing out a branch, also occur. The root is rather darker in colour but not very different in structure from the stem.

The fracture of the stem is coarse and fibrous. The transverse section, whether of stem or root, shows a thickish, corky bark surrounding a light brown wood composed of a number of converging wedges (10 to 20) of very porous structure, separated by narrow medullary rays. There are *no concentric layers* of wood,[2] nor is the arrangement of the wedges oblique as in many other stems of the order. The drug is inodorous, but has a very bitter taste without sweetness or astringency.

2. *Common False Pareira Brava*—Under this name we designate the drug which for many years past has been the ordinary Pareira Brava of the shops, and regarded until lately as derived from *Cissampelos Pareira* L. We have long endeavoured to ascertain, through correspondents in Brazil, from what plant it is derived, but without success. We only know that it belongs to the order *Menispermaceæ.*

The drug consists of a ponderous, woody, tortuous stem and root, occurring in pieces from a few inches to a foot or more in length, and from 1 to 4 inches in thickness, coated with a thin, hard, dark brown

[1] "Presentamente [Abutua] é reputada diaphoretica, diuretica e emenagoga, e usada interiormente na dóse de duas a quatro oitavas para uma libra de infusão ou cozimento, nas febres intermittentes, hydropisias, e suspensão de lochios."—Langgaard, *Diccionario de Medicina domestica e popular*, Rio de Janeiro, i. (1865) 17.

[2] It is therefore entirely different to the wood figured as that of *C. Pareira* by Eichler in Martius' *Flor. Bras.* xiii. pars. i. tab. 50. fig. 7.

bark. The pieces are cylindrical, four-sided, or more or less flattened—sometimes even to the extent of becoming ribbon-like. In transverse section, their structure appears very remarkable. Supposing the piece to be *stem*, a well-defined pith will be found to occupy the centre of the first formed wood, which is a column about $\frac{1}{4}$ of an inch in diameter. This is succeeded by 10 to 15 or more concentric or oftener eccentric zones, $\frac{1}{10}$ to $\frac{2}{10}$ of an inch wide, each separated from its neighbour by a layer of parenchyme, the outermost being coated with a true bark. In pieces of *true root*, the pith is reduced to a mere point.

Sometimes the development of the zones has been so irregular that they have formed themselves entirely on one side of the primitive column, the other being coated with bark. The zones, including the layer around the pith (if pith is present), are crossed by numerous small medullary rays. These do not run from the centre to the circumference, but traverse only their respective zones, on the outside of which they are arched together.

The drug, when of good quality, has its wood firm, compact, and of a dusky yellowish brown hue, and a well-marked bitter taste. It exhibits under the knife nothing of the close waxy texture seen in the root of *Chondodendron*, but cuts as a tough, fibrous wood. Its decoction is not tinged blue by iodine. It was in this drug that Wiggers in 1839 discovered *pelosine*.

The drug just described which is by no means devoid of medicinal power, has of late years been almost entirely supplanted in the market by another sort consisting exclusively of stems which are devoid of bitterness and appear to be wholly inert. They are in the form of sticks or truncheons, mostly cylindrical. Cut transversely they display the same structure as the sort last described, with a well-defined pith. The wood is light in weight, of a dull tint, and disposed to split. The bark which consists of two layers is easily detached.

3. *Stems of Chondodendron tomentosum* R. et P.—These have been recently imported from Brazil, and sold as *Pareira Brava*.[1] The drug consists of truncheons about 1½ feet in length, of a rather rough and knotty stem, from 1 to 4 inches thick.[2] The larger pieces, which are sometimes hollow with age, display, when cut transversely, a small number (5—9) nearly concentric woody zones. The youngest pieces have the bark dotted over with small dark warts.

The wood is inodorous, but has a bitterish taste like the root, of which it is probably an efficient representative. Some pieces have portions of root springing from them, and detached roots occur here and there among the bits of stem.

4. *White Pareira Brava*—Stems and roots of *Abuta rufescens* Aublet.—Mr. J. Correa de Méllo of Campinas has been good enough to send to one of us (H.) a specimen of the root and leaves[3] of this plant marked *Parreira Brava grande*. The former we have identified with a drug received from Rio de Janeiro as *Abutua Unha de Vaca*, i.e. *Cow-hoof*

[1] 45 packages containing about 20 cwt. were offered for sale by Messrs. Lewis and Peat, drug-brokers, 11 Sept. 1873, but there had been earlier importations.

[2] From these knots, which are at regular intervals and sometimes very protuberant, it would appear that the panicles of flower arise year after year.

[3] I have compared these leaves wit Aublet's own specimen in the British Museum.—D. H.

Abutua, and also with a similar drug found in the London market. Aublet[1] states that the root of *Abuta rufescens* was, in the time of his visit to French Guiana, shipped from that colony to Europe as *Pareira Brava blanc* (White Pareira Brava).

This name is well applicable to the drug before us, which consists of short pieces of a root, ½ an inch to 3 inches thick, covered with a rough blackish bark, and also of bits of stem having a pale, striated, corky bark. Cut transversely the root displays a series of concentric zones of white amylaceous cellular tissue, each beautifully marked with narrow wedge-shaped medullary rays of dark, porous tissue. The wood of the stem is harder than that of the root, the medullary rays are closer together and broader, and there is a distinct pith.

The wood, neither of root nor stem, has any taste or smell. A decoction of the root is turned bright blue by iodine.

5. *Yellow Pareira Brava*—This drug of which a quantity was in the hands of a London drug-broker in 1873, is, we presume, the *Pareira Brava jaune* of Aublet—the bitter tasting stem of his "*Abuta amara* folio levi cordiformi ligno flavescente,"—a plant of Guiana unknown to recent botanists. That which we have seen consists of portions of a hard woody stem, from 1 to 5 or 6 inches in diameter, covered with a whitish bark. Internally it is marked by numerous regular concentric zones, is of a bright yellow colour and of a bitter taste. It probably contains berberine.

COCCULUS INDICUS.

Fructus Cocculi; Cocculus Indicus; F. *Coque du Levant;* G. *Kokkelskörner.*

Botanical Origin—*Anamirta Cocculus* Wight et Arnott (*Menispermum Cocculus* L.), a strong climbing shrub found in the eastern parts of the Indian peninsula from Concan and Orissa to Malabar and Ceylon, in Eastern Bengal, Khasia and Assam, and in the Malayan Islands.

History—It is commonly asserted that *Cocculus Indicus* was introduced into Europe through the Arabs, but the fact is difficult of proof; for though Avicenna[2] and other early writers mention a drug having the power of poisoning fish, they describe it as a *bark*, and make no allusion to it as a production of India. Even Ibn Baytar[3] in the 13th century professed his inability to discover what substance the older Arabian authors had in view.

Cocculus Indicus is not named by the writers of the School of Salernum. The first mention of it we have met with is by Ruellius,[4] who alluding to the property possessed by the roots of *Aristolochia* and *Cyclamen* of attracting fishes, states that the same power exists in the little berries found in the shops under the name of *Cocci Orientis*, which when scattered on water stupefy the fishes, so that they may be captured by the hand.

Valerius Cordus,[5] who died at Rome in 1543, thought the drug which he calls *Cuculi de Levante*, to be the fruit of a *Solanum* growing in Egypt.

[1] *Hist. des Plantes de la Guiane Françoise*, i. (1775) 618. tab. 250.

[2] Valgrisi edition, 1564, lib. ii. tract. 2. cap. 485.

[3] Sontheimer's transl. ii. 460.

[4] *De Natura Stirpium*, Paris, 1536. lib. iii. c. 4.

[5] *Adnotationes*, 1549. cap. 63 (p. 509).

Dalechamps[1] repeated this statement in 1586, at which period and or long afterwards, Cocculus Indicus used to reach Europe from Alexandria and other parts of the Levant. Gerarde,[2] who gives a very good gure of it, says it is well known in England (1597) as *Cocculus Indicus*, therwise *Cocci* vel *Cocculæ Orientales*, and that it is used for destroying ermin and poisoning fish. In 1635 it was subject to an import duty of a per lb., as *Cocculus Indiæ*.[3]

The use of Cocculus Indicus in medicine was advocated by Battista Codronchi, a celebrated Italian physician of the 16th century, in a ractate entitled *De Baccis Orientalibus*.[4]

The word *Cocculus* is derived from the Italian *coccola*, signifying a mall, berry-like fruit.[5] Mattioli remarks that as the berries when first brought from the East to Italy had no special name, they got to be called *Coccole di Levante*.[6]

Description—The female flower of *Anamirta* has normally 5 ovaries placed on a short gynophore. The latter, as it grows, becomes raised into a stalk about ½ an inch long, articulated at the summit with shorter stalks, each supporting a drupe, which is a matured ovary. The purple drupes thus produced are 1 to 3 in number, of gibbous ovoid form, with the persistent stigma on the straight side, and in a line with the shorter stalk or carpodium. They grow in a pendulous panicle, a foot or more in length.

These fruits removed from their stalks and dried have the aspect of little round berries, and constitute the Cocculus Indicus of commerce. As met with in the market they are shortly ovoid or subreniform, $\frac{4}{10}$ to $\frac{6}{10}$ of an inch long, with a blackish, wrinkled surface, and an obscure ridge running round the back. The shorter stalk, when present, supports the fruit very obliquely. The pericarp, consisting of a wrinkled skin covering a thin woody endocarp, encloses a single reniform seed, into which the endocarp deeply intrudes. In transverse section the seed has a horse-shoe form; it consists chiefly of albumen, enclosing a pair of large, diverging lanceolate cotyledons, with a short terete radicle.[7]

The seed is bitter and oily, the pericarp tasteless. The drug is preferred when of dark colour, free from stalks, and fresh, with the seeds well preserved.

Microscopic Structure—The woody endocarp is built up of a peculiar sclerenchymatous tissue, consisting of branched, somewhat elongated cells. They are densely packed, and run in various directions, showing but small cavities. The parenchyme of the seed is loaded with crystallized fatty matter.

Chemical Composition—*Picrotoxin*, $C^{12}H^{14}O^{5}$, a crystallizable substance occurring in the seed to the extent of ⅔ to 1 per cent., was observed by Boullay, as early as 1812, and is the source of the poisonous property of the drug. Picrotoxin does not neutralize acids. It dissolves in water and in alkalis; the solution in the latter reduces cupric oxide like the sugars, but to a much smaller extent than glucose. The alka-

[1] *Hist. Gen. Plant.* 1586. 1722.

[2] *Herball*, Lond. 1636. 1548-49.

[3] *The Rates of Marchandises*, Lond. 1635.

[4] It forms part of his work *De Christiana ex tuis medendi ratione*, Ferrariæ, 1591.

[5] Frutto d'alcuni alberi, e d'alcune piante, e erbe salvatiche, come cipresso, ginepro, alloro, pugnitopo, e lentischio, e simili.—Lat. *bacca*; Gr. ἀκρόδρυα.—*Vocabolario degli Accademici della Crusca.*

[6] Quoted by J. J. von Tschudi, *Die Kokkelskörner und das Pikrotoxin*, St. Gallen, 1847.

[7] The fruit should be macerated in order to examine its structure.

line solution is not precipitated by chloride of ammonium. The aqueous solution of picrotoxin is not altered by any metallic salt, or by tannin, iodic acid, iodohydrargyrate or bichromate of potassium—in fact by none of the reagents which affect the alkaloids. It may thus be easily distinguished from the bitter poisonous alkaloids, although in its behaviour with concentrated sulphuric acid and bichromate of potassium it somewhat resembles strychnine, as shown in 1867 by Köhler.

Pelletier and Couerbe (1833) obtained from the pericarp of Cocculus Indicus two crystallizable, tasteless, non-poisonous substances, having the same composition, and termed respectively *Menispermine* and *Paramenispermine*. These bodies, as well as the very doubtful amorphous *Hypopicrotoxic Acid* of the same chemists, require re-examination.

The fat of the seed which amounts to about half its weight, is used in India for industrial purposes. Its acid constituent, formerly regarded as a peculiar substance under the name of *Stearophanic* or *Anamirtic Acid*, was found by Heintz to be identical with stearic acid.

Commerce—Cocculus Indicus is imported from Bombay and Madras, but we have no statistics showing to what extent. The stock in the dock warehouses of London on 1st of December, 1873, was 1168 packages, against 2010 packages on the same day of the previous year. The drug is mostly shipped to the continent, the consumption in Great Britain being very small.

Uses—In British medicine Cocculus Indicus is only employed as an ingredient of an ointment for the destruction of *pediculi*. It has been discarded from the *British Pharmacopœia*, but has a place in that of India.

GULANCHA.

Caulis et radix Tinosporæ.

Botanical Origin—*Tinospora cordifolia* Miers (*Cocculus cordifolius* DC.), a lofty climbing shrub found throughout tropical India from Kumaon to Assam and Burma, and from Concan to Ceylon and the Carnatic. It is called in Hindustani *Gulancha*.

History—The virtues of this plant which appear to have been long familiar to the Hindu physicians, attracted the attention of Europeans in India at the early part of the present century.[1] According to a paper published at Calcutta in 1827,[2] the parts used are the stem, leaves, and root, which are given in decoction, infusion, or a sort of extract called *pálo*, in a variety of diseases attended with slight febrile symptoms.

O'Shaughnessy declares the plant to be one of the most valuable in India, and that it has proved a very useful tonic. Similar favourable testimony is borne by Waring. Gulancha was admitted to the *Bengal Pharmacopœia* of 1844, and to the *Pharmacopœia of India* of 1868.

Description—The stems are perennial, twining and succulent, running over the highest trees and throwing out roots many yards in length which descend like slender cords to the earth. They have a thick corky bark marked with little prominent tubercles.

[1] Fleming, *Catal. of Indian Med. Plants and Drugs*, Calcutta, 1810. 27.

[2] On the native drug called *Gulancha* by Ram Comol Shen.—*Trans. of Med. and Phys. Soc. of Calcutta*, iii. (1827) 295.

As found in the bazaars the drug occurs as short transverse segments a cylindrical woody stem from ¼ of an inch up to 2 inches in diameter. ıey exhibit a shrunken appearance, especially those derived from the ›unger stems, and are covered with a smooth, translucent, shrivelled ırk which becomes dull and rugose with age. Many of the pieces are arked with warty prominences and the scars of adventitious roots. he outer layer which is easily detached covers a shrunken parenchyme. he transverse section of the stem shows it to be divided by about 12 › 14 medullary rays into the same number of wedge-shaped woody andles having very large vessels, but no concentric structure. The rug is inodorous but has a very bitter taste. The root is stated by O'Shaughnessy[1] to be large, soft and spongy.

Microscopic Structure—The suberous coat consists of alternating ayers of flat corky cells and sclerenchyme, sometimes of a yellow :olour. The structure of the central part reminds one of that of *Cissampelos Pareira* (p. 28), like which it is not divided into concentric ıones. The woody rays which are sometimes intersected by parenchyme, are surrounded by a loose circle of arched bundles of liber tissue.

Chemical Composition—No analysis worthy of the name has been made of this drug, and the nature of its bitter principle is wholly unknown. We have had no material at our disposal sufficient for chemical examination.

Uses—Gulancha is reputed to be tonic, antiperiodic and diuretic. According to Waring[2] it is useful in mild forms of intermittent fever, in debility after fevers and other exhausting diseases, in secondary syphilitic affections and chronic rheumatism.

Substitute—*Tinospora crispa* Miers, an allied species occurring in Silhet, Pegu, Java, Sumatra, and the Philippines, possesses similar properties, and is highly esteemed in the Indian Archipelago as a febrifuge

BERBERIDEÆ.

CORTEX BERBERIDIS INDICUS.

Indian Barberry Bark.

Botanical Origin—This drug is allowed in the *Pharmacopœia of India* to be taken indifferently from three Indian species of *Berberis*[3] which are the following :—

1. *Berberis aristata* DC., a variable species occurring in the temperate regions of the Himalaya at 6000 to 10,000 feet elevation, also found in the Nilghiri mountains and Ceylon.

2. *B. Lycium* Royle, an erect, rigid shrub found in dry, hot situations of the western part of the Himalaya range at 3000 to 9000 feet above the sea-level.

3. *B. asiatica* Roxb.—This species has a wider distribution than the last, being found in the dry valleys of Bhotan and Nepal whence it

[1] *Bengal Dispensatory*, 1842, 198.
[2] *Pharm. of India*, 1868, 9.
[3] For remarks on the Indian species of *Berberis*, see Hooker and Thomson's *Flora Indica* (1855), also Hooker's *Flora of British India*, i. (1872) 109.

stretches westward along the Himalaya to Garwhal, and occurs again in Affghanistan.

History—The medical practitioners of ancient Greece and Italy made use of a substance called *Lycium* (λύκιον) of which the best kind was brought from India. It was regarded as a remedy of great value in restraining inflammatory and other discharges; but of all the uses to which it was applied the most important was the treatment of various forms of ophthalmic inflammation.

Lycium is mentioned by Dioscorides, Pliny, Celsus, Galen, and Scribonius Largus; by such later Greek writers as Paulus Æginetæ, Ætius, and Oribasius, as well as by the Arabian physicians.

The author of the Periplus of the Erythrean Sea who probably lived in the 1st century, enumerates λύκιον as one of the exports of Barbarike at the mouth of the Indus, and also names it along with Bdellium and Costus among the commodities brought to Barygaza:—and further, lycium is mentioned among the Indian drugs on which duty was levied at the Roman custom house of Alexandria about A.D. 176—180.[1]

An interesting proof of the esteem in which it was held is afforded by some singular little vases or jars of which a few specimens are preserved in collections of Greek antiquities.[2] These vases were made to contain lycium, and in them it was probably sold; for an inscription on the vessel not only gives the name of the drug but also that of a person who, we may presume, was either the seller or the inventor of the composition. Thus we have the *Lycium* of *Jason*, of *Musæus*, and of *Heracleus*. The vases bearing the name of Jason were found at Tarentum, and there is reason to believe that that marked *Heracleus* was from the same locality. Whether it was so or not, we know that a certain Heraclides of Tarentum is mentioned by Celsus[3] on account of his method of treating certain diseases of the eye; and that Galen gives formulæ for ophthalmic medicines[4] on the authority of the same person.

Innumerable conjectures were put forth during at least three centuries as to the origin and nature of lycium, and especially of that highly esteemed kind that was brought from India.

In the year 1833, Royle[5] communicated to the Linnean Society of London a paper proving that the Indian Lycium of the ancients was identical with an extract prepared from the wood or root of several species of *Berberis* growing in Northern India, and that this extract, well known in the bazaars as *Rusot* or *Rasot*, was in common use among the natives in various forms of eye disease.[6] This substance attracted considerable notice in India, and though its efficacy *per se*[7] seemed

[1] Vincent, *Commerce and Navigation of the Ancients in the Indian Ocean*, ii. (1807) 390, 410, 734.

[2] Figures of these vessels were published by Dr. J. Y. Simpson in an interesting paper entitled *Notes on some ancient Greek medical vases for containing Lycium*, of which we have made free use.—See (*Edinb.*) *Monthly Journal of Med. Science*, xvi. (1853) 24, also *Pharm. Journ.* xiii. (1854) 413.

[3] Lib. vii. c. 7.—See also Cælius Aurelianus, *De morbis chronicis* (Haller's ed.) lib. i. c. 4, lib. iii. c. 8.

[4] Cataplasmata lippientium quibus usus est Heraclides Tarentinus.—Galen, *De Comp. Med. sec. locos*, lib. iv. (p. 153 in Venice edit. of 1625).

[5] On the *Lycium* of Dioscorides.—*Linn. Trans.* xvii. (1837) 83.

[6] It is interesting to find that two of the names for *lycium* given by Ibn Baytar in the 13th century are precisely those under which *rusot* is met with in the Indian bazaars at the present day.

[7] The natives apply it in combination with alum and opium.

ıtionable, it was administered with benefit as a tonic and febrifuge.[1] the *rusot* of the natives being often badly prepared or adulterated, bark of the root has of late been used in its place, and in conıence of its acknowledged efficacy has been admitted to the *rmacopœia of India.*

Description—In *B. asiatica* (the only species we have examined) the s which are thick and woody, and internally of a bright yellow, are ıred with a thin, brittle bark. The bark has a light-brown corky ır, beneath which it appears of a darker and greenish-yellow hue, and ıposed of coarse fibres running longitudinally. The inner surface a glistening appearance by reason of fine longitudinal striæ. The t is inodorous and very bitter.

Chemical Composition—Solly [2] pointed out in 1843 that the root-k of the Ceylon barberry [*B. aristata*] contains the same yellow ouring matter as the barberry of Europe. L. W. Stewart [3] extracted *rberine* in abundance from the barberry of the Nilghiri Hills and ırthern India, and presented specimens of it to one of us in 1865.

The root-bark of *Berberis vulgaris* L. was found by Polex (1836) to ıtain another alkaloid named *Oxyacanthine*, which forms with acids lourless crystallizable salts of bitter taste.[4]

Uses—The root-bark of the Indian barberries administered as a ıcture has been found extremely useful in India in the treatment of ıers of all types. It has also been given with advantage in diarrhœa d dyspepsia, and as a tonic for general debility.

RHIZOMA PODOPHYLLI.

Radix podophylli ; Podophyllum Root.

Botanical Origin—*Podophyllum peltatum* L., a perennial herb grow-g in moist shady situations throughout the eastern side of the North ıerican continent from Hudson's Bay to New Orleans and Florida.

The stem about a foot high, bears a large, solitary, white flower, rising ım between two leaves of the size of the hand composed of 5 to 7 ıdge-shaped divisions, somewhat lobed and toothed at the apex. The llowish pulpy fruit of the size of a pigeon's egg is slightly acid and is ıetimes eaten under the name of *May Apple.* The leaves partake of active properties of the root.

History—The virtues of the rhizome as an anthelmintic and emetic ıve been long known to the Indians of North America. The plant ıs figured in 1731 by Catesby [5] who remarks that its root is an excellent ıetic. Its cathartic properties were noticed by Barton in 1798 [6] and ıve been commented upon by many subsequent writers. In 1820, ıdophyllum was introduced into the *United States Pharmacopœia*, and 1864 into the *British Pharmacopœia.* Hodgson published in 1832 in *Journal of the Philadelphia College of Pharmacy* [7] the first chemical ıservations on the rhizome, which now furnishes one of the most

[1] O'Shaughnessy, *Bengal Dispensatory* (1842) 203—205.
[2] *Journ. of R. Asiat. Soc.* vii. (1843) 74.
[3] *Pharm. Journ.* vii. (1866) 303.
[4] Gmelin, *Chemistry*, xvii. (1866) 197.
[5] *Nat. Hist. of Carolina*, i. tab. 24.
[6] *Collections for an Essay on Mat. Med. of U. S.* Philad. 1798. 31.
[7] Vol. iii. 273.

popular purgatives, the so-called *Podophyllin*, manufactured on a large scale at Cincinnati and in other places in America, as well as in England.

Description—The drug consists of the rhizome and rootlets. The former creeps to a length of several feet, but as imported is mostly in somewhat flattened pieces of 1 to 8 inches in length and 2 to 4 lines in longest diameter; it is marked by knotty joints showing a depressed scar at intervals of a few inches which marks the place of a fallen stem. Each joint is in fact the growth of one year, the terminal bud being enclosed in papery brownish sheaths. Sometimes the knots produce one, two, or even three lateral buds and the rhizome is bi- or tri-furcate. The reddish-brown or grey surface is obscurely marked at intervals by oblique wrinkles indicating the former attachment of rudimentary leaves. The rootlets are about ½ a line thick and arise from below the knots and adjacent parts of the rhizome, the internodal space being bare. They are brittle, easily detached, and commonly of a paler colour. The rhizome is mostly smooth, but some of the branched pieces are deeply furrowed. Both rootstock and rootlets have a short, smooth, mealy fracture; the transverse section is white, exhibiting only an extremely small corky layer and a thin simple circle of about 20 to 40 yellow, vascular bundles, enclosing a central pith which in the larger pieces is often 2 lines in diameter.

The drug has a heavy narcotic, disagreeable odour, and a bitter, acrid, nauseous taste.

Microscopic Structure—The vascular bundles are composed of spiral and scalariform vessels intermixed with cambial tissue. From each bundle a narrow-tissued, wedge- or crescent-shaped liber-bundle projects a little into the cortical layer. This, as well as the pith, exhibits large thin-walled cells. The rootlets are as usual of a different structure, their central part consisting of one group of vascular bundles more or less scattered. The parenchymatous cells of the drug are loaded with starch granules; some also contain stellate tufts of oxalate of calcium. Tannic matter is present in very small amount, as proved by perchloride of iron.

Chemical Composition—The active principles of podophyllum exist in the resin, which according to Squibb[1] is best prepared by the process termed *re-percolation*. The powdered drug is exhausted by alcohol which is made to percolate through successive portions. The strong tincture thus obtained is slowly poured into a large quantity of water acidulated with hydrochloric acid (one measure of acid to 70 of water), and the precipitated resin dried at a temperature not exceeding 32° C. The acid is used to facilitate the subsidence of the pulverulent resin which according to Maisch settles down but very slowly if precipitated by cold water simply, and if thrown down by hot water fuses into a dark brown cake which however has the advantage of being nearly free from berberine.

Resin of podophyllum thus prepared is a light, brownish-yellow powder with a tinge of green, devoid of crystalline appearance, becoming darker if exposed to a heat above 32° C., and having an acrid, bitter taste. The drug yields 3½ to 5 per cent. of this resin which is very incorrectly called *Podophyllin*. The product is the same whether the rhizome or the

[1] *American Journ. of Pharm.* xvi. (1868) 1—10.

pellets are exclusively employed.[1] It is soluble in caustic, less freely in carbonated alkalis, and is precipitated, apparently without alteration, on addition of an acid. Ether separates it into two nearly equal portions, the one soluble in the menstruum, the other not, but both energetically purgative. From the statements of Credner[2] it appears that if caustic lye is shaken with the ethereal solution, about half the resin combines with the potash while the other half remains dissolved in the ether. If an acid is added to the potassic solution, a red-brown precipitate is produced which is no longer soluble in ether nor possessed of purgative power. According to Credner, the body of greatest purgative activity was precipitated by ether from an alcoholic solution of crude podophyllin. It was however found after due purification to be soluble in ether.

F. F. Mayer[3] of New York found podophyllum to contain beside the resin already mentioned, a large proportion of *Berberine*, and a colourless alkaloid, a peculiar (?) acid, an odoriferous principle which may be obtained by sublimation in colourless scales, and finally *Saponin*. From all these bodies the resin as prepared for pharmaceutical use by Squibb's process is free, provided that after precipitation, it is well washed with hot water to remove the berberine. An aqueous extract of podophyllum is devoid of cathartic power.

Uses—Podophyllum is only employed for the preparation of the resin (*Resina Podophylli*) which is now much prescribed as a purgative.

PAPAVERACEÆ.

PETALA RHŒADOS.

Flores Rhœados; Red Poppy Petals; F. *Fleurs de Coquelicot;* G. *Klatschrosen.*

Botanical Origin—*Papaver Rhœas* L.—The common Red Poppy or Corn Rose is an annual herb found in fields throughout the greater part of Europe often in extreme abundance. It almost always occurs as an accompaniment of cereal crops, frequently disappearing when this cultivation is given up. It is plentiful in England and Ireland, but less so in Scotland; is found abundantly in Central and Southern Europe and in Asia Minor, whence it extends as far as Palestine and the banks of the Euphrates. But it does not occur in India or in North America.

From the evidence adduced by De Candolle,[4] it would appear that the plant is strictly indigenous to Sicily, Greece, Dalmatia, and possibly the Caucasus.

History—*Papaver Rhœas* was known to the ancients, though doubtless it was often confounded with *P. dubium* L. the flowers of which are rather smaller and paler. The petals were used in pharmacy in the time of Dodonæus (1550).

Description—The branches of the stem are upright, each terminating in a conspicuous long-stalked flower, from which as it opens the

[1] Saunders in *Am. Journ. of Pharm.* xvi. 1.

[2] *Ueber Podophyllin* (*Dissertation*), Giessen, 1869.

[3] *Am. Journ. of Pharmacy*, xxxv. (1863) 97.

[4] *Géogr. botanique*, ii. (1855) 649.

two sepals fall off. The delicate scarlet petals are four in number, transversely elliptical and attached below the ovary by very short, dark-violet claws. As they are broader than long, their edges overlap in the expanded flower. In the bud they are irregularly crumpled, but when unfolded are smooth, lustrous, and unctuous to the touch. They fall off very quickly, shrink up in drying, and assume a brownish-violet tint even when dried with the utmost care. Although they do not contain a milky juice like the green parts of the plant, they have while fresh a strong narcotic odour and a faintly bitter taste.

Chemical Composition—The most important constituent of the petals is the colouring matter, still but very imperfectly known. According to L. Meier (1846) it consists of two substances, *Rhœadic* and *Papaveric Acids*, neither of which could be obtained other than in an amorphous state. The colouring matter is abundantly taken up by water or spirit of wine but not by ether. The aqueous infusion is not precipitated by alum but yields a dingy violet precipitate with acetate of lead, and is coloured blackish-brown by ferric salts or by alkalis.

The alkaloids of opium cannot be detected in the petals. Attfield in particular has examined the latter (1873) for morphine but without obtaining a trace of that body.

The milky juice of the herb and capsules has a narcotic odour, and appears to exert a distinctly sedative action. Hesse (1865) obtained from the plant a colourless, crystallizable substance, *Rhœadine*, $C^{21}H^{21}NO^{6}$, of weak alkaline reaction. It is tasteless, not poisonous, nearly insoluble in water, alcohol, ether, chloroform, benzol, or aqueous ammonia, but dissolves in weak acids. Its solution in dilute sulphuric or hydrochloric acid acquires after a time a splendid red colour, destroyed by an alkali but reappearing on addition of an acid.

Uses—Red Poppy petals are employed in pharmacy only for the sake of their fine colouring matter. They should be preferred in the fresh state.

CAPSULÆ PAPAVERIS.

Fructus Papaveris; Poppy Capsules, Poppy Heads; F. *Capsules ou Têtes de Pavot;* G. *Mohnkapseln.*

Botanical Origin—*Papaver somniferum* L. Independently of the garden-forms of this universally known annual plant, we may, following Boissier,[1] distinguish three principal varieties, viz.:—

α. *setigerum* (*P. setigerum* DC.), occurring in the Peloponnesus, Cyprus, Corsica and the islands of Hières, the truly wild form of the plant with acutely toothed leaves, the lobes sharp-pointed and each terminating in a bristle. The leaves, peduncles, and sepals are covered with scattered bristly hairs, and the stigmata are 7 or 8 in number.

β. *glabrum*—Capsule subglobular, stigmata 10 to 12. Chiefly cultivated in Asia Minor and Egypt.

γ. *album* (*P. officinale* Gmelin)—has the capsule more or less egg-shaped and devoid of apertures. It is cultivated in Persia.

Besides the differences indicated above, the petals vary from white to red or violet, with usually a dark purplish spot at the base of each.[2] The seeds also vary from white to slate-coloured.

[1] *Flora Orientalis*, i. (1867) 116. [2] English growers prefer a *white-flowered* poppy.

History—The poppy has been known from a remote period throughout the eastern countries of the Mediterranean, Asia Minor, and Central Asia, in all which regions its cultivation is of very ancient date.

Syrup of poppies, a medicine still in daily use, is recommended as a sedative in catarrh and cough in the writings of the younger Mesue (*ob.* A.D. 1015) who studied at Bagdad, and subsequently resided at Cairo as physician to the Caliph of Egypt. In the *Ricettario Fiorentino* said to be the earliest pharmacopœia published by authority, and of which the first edition was printed in 1498, a formula is given for the syrup as *Siroppo di Papaveri semplici di Mesue*; in the first pharmacopœia of the London College (1618), the medicine is prescribed as *Syrupus de Meconio Mesuæ.*

Description—The fruit is formed by the union of 8 to 20 carpels, the edges of which are turned inwards and project like partitions towards the interior, yet without reaching the centre, so that the fruit is really one-celled. In the unripe fruit, the sutures of the carpels are distinctly visible externally as shallow longitudinal stripes.

The fruit is crowned with a circular disc, deeply cut into angular ridge-like stigmas in number equal to the carpels, projecting in a stellate manner with short obtuse lobes. Each carpel opens immediately below the disc by a pore, out of which the seeds may be shaken; but in some varieties of poppy the carpel presents no aperture even when fully ripe. The fruit is globular, sometimes flattened below, or it is ovoid; it is contracted beneath into a sort of neck immediately above a tumid ring at its point of attachment with the stalk. Grown in rich moist ground in England, it often attains a diameter of three inches, which is twice that of the capsules of the opium poppy of Asia Minor or India. While growing it is of a pale glaucous green, but at maturity becomes yellowish brown, often marked with black spots. The outer wall of the pericarp is smooth and hard; the rest is of a loose texture, and while green exudes on the slightest puncture an abundance of bitter milky juice. The interior surface of the pericarp is rugose, and minutely and beautifully striated transversely. From its sutures spring thin and brittle placentæ directed towards the centre and bearing on their perpendicular faces and edges a vast number of minute reniform seeds.

The unripe fruit has a narcotic odour which is destroyed by drying; and its bitter taste is but partially retained.

Microscopic Structure—The outer layer consists of a thin cuticle exhibiting a large number of stomata; the epidermis is formed of a row of small thick-walled cells. Fragments of these two layers, which on the whole exhibit no striking peculiarity, are always found in the residue of opium after it has been exhausted by water.

The most interesting part of the constituent tissues of the fruit is the system of laticiferous vessels, which is of an extremely complicated nature inasmuch as it is composed of various kinds of cells intimately interlaced so as to form considerable bundles.[1] The cells containing the milky juice are larger but not so much branched as in many other plants.

Chemical Composition—The analyses of poppy heads present discrepant results with regard to morphine. Merck and Winckler detected it in the ripe fruit to the extent of 2 per cent., and it has also been found by Groves (1854) and by Deschamps d'Avallon (1864). Other chemists have been unable to find it.

[1] For particulars see Trécul, *Ann. des Sciences Nat.* v. (1866) 49.

In recent pharmacopœias poppy heads are directed to be taken previous to complete maturity, and both Meurein and Aubergier have shown that in this state they are richer in morphine than when more advanced. Deschamps d'Avallon found them sometimes to contain narcotine. He also obtained mucilage perceptible by neutral acetate of lead, ammonium salts, meconic, tartaric, and citric acid, the ordinary mineral acids, wax, and lastly two new crystalline bodies, *Papaverin*, and *Papaverosine*. The former is not identical with Merck's alkaloid of the same name; although nitrogenous and bitter, it has an acid reaction (?) yet does not combine with bases. It yields a blue precipitate with a solution of iodine in iodide of potassium.

Papaverosine on the other hand is a base to which sulphuric acid imparts a violet colour, changing to dark yellowish-red on addition of nitric acid.

In ripe poppy heads, Hesse (1866) found *Rhœadine*. Groves in 1854 somewhat doubtfully announced the presence of *Codeine*. Ripe poppy capsules (seeds removed) dried at 100° C. afforded 14·28 per cent. of ash, consisting chiefly of alkaline chlorides and sulphates, with but a small quantity of phosphate.

Production—Poppies are grown for medicinal use in many parts of England, mostly on a small scale. The large and fine fruits (poppy heads) are usually sold entire; the smaller and less sightly are broken and the seeds having been removed, are supplied to the druggist for pharmaceutical preparations. The directions of the pharmacopœia as to the fruit being gathered when "nearly ripe" does not appear to be much regarded.

Uses—In the form of syrup and extract, poppy heads are in common use as a sedative. A hot decoction is often externally applied as an anodyne.

OPIUM.

Botanical Origin—*Papaver somniferum* L., see preceding article.

History—The medicinal properties of the milky juice of the poppy have been known from a remote period. Theophrastus who lived in the beginning of the 3rd century B.C. was acquainted with the substance in question, under the name of Μηκώνιον.

Scribonius Largus in his *Compositiones Medicamentorum*[1] (*circa* A.D. 40) notices the method of procuring opium, and points out that the true drug is derived from the capsules, and not from the foliage of the plant.

About the year 77 of the same century, Dioscorides[2] plainly distinguished the juice of the capsules under the name of ὀπός from an extract of the entire plant, μηκώνειον, which he regarded as much less active. He described exactly how the capsules should be incised, the performing of which operation he designated by the verb ὀπίζειν. We may infer from these statements of Dioscorides that the collection of opium was at that early period a branch of industry in Asia Minor. The same authority alludes to the adulteration of the drug with the milky juices of *Glaucium* and *Lactuca*, and with gum.

Pliny[3] devotes some space to an account of *Opion*, of which he describes the medicinal use. The drug is repeatedly mentioned as

[1] Ed. Bernhold, Argent. 1786, c. iii. sect. 22.
[2] Lib. iv. c. 65.
[3] Lib. xx. c. 76.

Lacrima papaveris by Celsus in the 1st century, and more or less particularly by numerous later Latin authors. During the classical period of the Roman Empire as well as in the early middle ages, the only sort of opium known was that of Asia Minor.

The use of the drug was transmitted by the Arabs to the nations of the East, and in the first instance to the Persians. From the Greek word ὀπός, *juice*, was formed the Arabic word *Afyun*, which has found its way into many Asiatic languages.[1]

The introduction of opium into India seems to have been connected with the spread of Islamism and may have been favoured by the Mahommedan prohibition of wine. The earliest mention of it as a production of that country occurs in the travels of Barbosa[2] who visited Calicut on the Malabar coast in 1511. Among the more valuable drugs the prices of which he quotes, opium occupies a prominent place. It was either imported from Aden or Cambay, that from the latter place being the cheaper, yet worth three or four times as much as camphor or benzoin.

Pyres[3] in his letter about Indian drugs to Manúel, king of Portugal, written from Cochin in 1516, speaks of the opium of Egypt, that of Cambay and of the kingdom of Coûs (Kus Bahár, S.W. of Bhotan) in Bengal. He adds that it is a great article of merchandize in these parts and fetches a good price;—that the kings and lords eat of it, and even the common people, though not so much because it costs dear.

Garçia d' Orta[4] informs us that the opium of Cambay in the middle of the 16th century was chiefly collected in Malwa, and that it is soft and yellowish. That from Aden and other places near the Erythrean Sea is black and hard. A superior kind was imported from Cairo, agreeing as Garçia supposed with the opium of the ancient Thebaid, a district of Upper Egypt near the modern Karnak and Luksor.

Prosper Alpinus[5] who visited Egypt in 1580–83, states that opium or meconium was in his time prepared in the Thebaid from the expressed juice of poppy heads. *Opium thebaïcum* was however mentioned long before this, by Simon Januensis,[6] physician to Pope Nicolas IV. (A.D. 1288-92), who also alludes to *meconium* as the dried juice of the pounded capsules and leaves. According to Unger's investigations (1857) Thebaic opium was not known to the ancient inhabitants of Egypt.

The German traveller Kämpfer who visited Persia about 1687 describes the various kinds of opium prepared in that country. The best sorts were flavoured with nutmeg, cardamom, cinnamon and mace, or simply with saffron and ambergris. Such compositions were called *Theriaka* and were held in great estimation during the middle ages and probably supplied to a large extent the place of pure opium. It was not uncommon for the sultans of Egypt of the 15th century to send presents of *Theriaka* to the doges of Venice and the sovereigns of Cyprus.[7]

[1] There are no ancient Chinese or Sanskrit names for opium. In the former language the drug is called *O-fu-yung* from the Arabic. The other names *Yu-pien* and *O-pien* are adaptations to the Chinese idiom of our word opium. There are several other designations which may be translated *Smoking dirt*, *Foreign poison*, *Black commodity*, &c.

[2] *Coasts of East Africa and Malabar* (Hakluyt Soc.), Lond. 1866. 206, 223.

[3] *Jorn. de Soc. Pharm. Lusit.* ii. (1838) 36.

[4] *Aromatum . . . Historia*, edit. Clusius, Antv. 1574. lib. i. c. 4.

[5] *De Medicina Ægyptiorum*, Lugd. Bat. 1719. 261.

[6] *Clavis Sanationis*, Venet. 1510. 46.

[7] De Mas Latrie *Hist. de Chypre*, iii. 406. 483; Muratori, *Rerum Italic. Scriptores*, xxii. 1170; Amari, *I diplomi Arabi del archivio Fiorentino*. Firenze, 1863. 358.

In mediæval Europe opium seems not to have been reckoned among the more costly drugs; in the 16th century we find it quoted at the same price as benzoin, and much cheaper than camphor, rhubarb, or manna.[1]

With regard to China it is supposed that opium was first brought thither by the Arabians, who are known to have traded with the southern ports of the empire as early as the 9th century. More recently, at least until the 16th century, the Chinese imported the drug in their junks as a return cargo from India. At this period it was used almost exclusively as a remedy for dysentery, and the whole quantity imported was very small. It was not until 1767 that the importation reached 1000 chests, at which rate it continued for some years, most of the trade being in the hands of the Portuguese. The East India Company made a small adventure in 1773; and seven years later an opium depôt of two small vessels was established by the English in Lark's Bay, south of Macao.

The Chinese authorities began to complain of these two ships in 1793 but the traffic still increased, and without serious interruption until 1820 when an edict was issued forbidding any vessel having opium on board to enter the Canton river. This led to a system of contraband trade with the connivance of the Chinese officials, which towards the expiration of the East India Company's charter in 1834, had assumed a regular character. The political difficulties between England and China that ensued shortly after this event, and the so-called Opium War, culminated in the Treaty of Nanking (1842), by which five ports of China were opened to foreign trade, and opium was admitted as a legal article of commerce.[2]

The vice of opium-smoking began to prevail in China in the second half of the 17th century,[3] and in another hundred years had spread like a plague over the gigantic empire. The first edict against the practice was issued in 1796, since which there have been innumerable enactments and memorials,[4] but all powerless to arrest the evil which is still increasing in an alarming ratio. Mr. Hughes, Commissioner of Customs at Amoy, thus wrote on this subject in his official *Trade Report*[5] for the year 1870:—"Opium-smoking appears here as elsewhere in China to be becoming yearly a more recognized habit,—almost a necessity of the people. Those who use the drug now do so openly, and native public opinion attaches no odium to its use, so long as it is not carried to excess. . . . In the city of Amoy and in adjacent cities and towns, the proportion of opium-smokers is estimated to be from 15 to 20 per cent. of the adult population. . . . In the country the proportion is stated to be from 5 to 10 per cent. . . ."

Production—The poppy in whatever region it may grow always contains a milky juice possessing the same properties; and the collection of opium is *possible* in all temperate and subtropical countries where the rainfall is not excessive. But the production of the drug is limited by other conditions than soil and climate, among which the value of land and labour stands pre-eminent.

[1] Fontanon, *Edicts et ordonnances des roys de France*, ii. (1585) 347.

[2] For more ample particulars on these momentous events, see S. Wells Williams's *Middle Kingdom*, vol. ii. (1848); *British Almanac Companion* for 1844, p. 77.

[3] Bretschneider, *Study of Chinese Bot. Works*, 1870. 47.

[4] *Chinese Repository*, vol. v. (1837) vi. &c.

[5] Addressed to the Inspector-General of Customs, Pekin, and published at Shanghai, 1871.

At the present day opium is produced on an important scale in Asia Minor, Persia, India, and China; to a small extent in Egypt. The drug has also been collected in Europe, Algeria,[1] North America,[2] and Australia,[3] but more for the sake of experiment than as an object of commerce.

We shall describe the production of the different kinds under their several names.

1. ***Opium of Asia Minor; Turkey, Smyrna, or Constantinople Opium.***[4]—The poppy from which this most important kind of opium is obtained is *Papaver somniferum*, var. *β. glabrum* Boissier. The flowers are commonly purplish, but sometimes white, and the seeds vary from white to dark violet.

The cultivation is carried on throughout Asia Minor, both on the more elevated and the lower lands, the cultivators being mostly small peasant proprietors. The plant requires a naturally rich and moist soil, further improved by manure, not to mention much care and attention on the part of the grower. Spring frosts, drought, or locusts sometimes effect its complete destruction. The sowing takes place at intervals from November to March, partly to insure against risk of total failure, and partly in order that the plants may not all come to perfection at the same time.

The plants flower between May and July according to the elevation of the land. A few days after the fall of the petals the poppy head being about an inch and a half in diameter is ready for incision. The incision is made with a knife transversely, about half-way up the capsule, and extends over about two-thirds the circumference, or is carried spirally to beyond its starting point. Great nicety is required not to cut too deep so as to penetrate the capsule, as in that case some of the juice would flow inside and be lost. The incisions are generally made in the afternoon and the next morning are found covered with exuded juice. This is scraped off with a knife, the gatherer transferring it to a poppy leaf which he holds in his left hand. At every alternate scraping, the knife is wetted with saliva by drawing it through the mouth, the object being to prevent the adhesion of the juice to the blade. Each poppy-head is, as a rule, cut only once; but as a plant produces several heads all of which are not of proper age at the same time, the operation of incising and gathering has to be gone over two or three times on the same plot of ground.

As soon as a sufficient quantity of the half-dried juice has been collected to form a cake or lump, it is wrapped in poppy leaves and put for a short time to dry in the shade. There is no given size for cakes of opium, and they vary in weight from a few ounces to more than two pounds. In some villages it is the practice to make the masses larger than in others. Before the opium is ready for the market, a meeting of buyers and sellers is held in each district, at which the price to be asked is discussed and settled,—the peasants being most of them in debt to the buyers or merchants.

[1] *Pharm. Journ.* xv. (1856) 348.
[2] *Am. Journ. of Phar.* xviii. (1870) 124; *Journ. of Soc. of Arts*, Dec. 1, 1871.
[3] *Pharm. Journ.* Oct. 1, 1870. 272.
[4] Much information under this head has been derived from a paper *On the production of Opium in Asia Minor* by S. H. Maltass (*Pharm. Journ.* xiv. 1855. 395), and one *On the Culture and Commerce in Opium in Asia Minor*, by E. R. Heffler, of Smyrna (*Pharm. Journ.* x. 1869. 434).

To the latter the opium is sold in a very soft but natural state. These dealers sometimes manipulate the soft drug with a wooden pestle into larger masses which they envelope in poppy leaves and pack in cotton bags sealed at the mouth for transport to Smyrna. According to another account, the opium as obtained from the grower is at once packed in bags together with a quantity of the little chaffy fruits of a dock (*Rumex* sp.) to prevent the lumps from sticking together, and so brought in baskets to Smyrna, or ports farther north.

The opium remains in the baskets (placed in cool warehouses to avoid loss of weight) till sold, and it is only on reaching the buyer's warehouse that the seals are broken and the contents of the bags exposed. This is done in the presence of the buyer, seller, and a public examiner, the last of whom goes through the process of inspecting the drug piece by piece, throwing aside any of suspicious quality. Heffler of Smyrna asserts that the drug is divided into three qualities, viz.—the *prime*, which is not so much a selected quality as the opium of some esteemed districts,—the *current* which is the mercantile quality and constitutes the great bulk of the crop,—and lastly the inferior or *chiqinti*.[1] The opium of very bad quality or wholly spurious he would place in a fourth category. Maltass applies the name *chiqinti* (or *chicantee*) to opium of every degree of badness.

The examination of opium by the official expert is not conducted in any scientific method. His opinion of the drug is based on colour, odour, appearance and weight, and appears to be generally very correct. Fayk Bey (1867) has recommended the Turkish government to adopt the more certain method of assaying opium by chemical means.

In Asia Minor the largest quantities of opium are now produced in the north-western districts of Karahissar Sahib, Balahissar, Kutaya, and Geiveh, the last on the river Sakariyeh which runs into the Black Sea. These centres of large production of opium send a superior quality of the drug to Constantinople by way of Izmid. Angora and Amasia are other places in the north of Asia Minor whence opium is obtained.

In the centre of the peninsula Afium Karahissar (literally *opium-black-castle*) and Ushak are important localities for opium, which is also the case with Isbarta, Buldur and Hamid farther south. The product of these districts finds its way to Smyrna, in the immediate neighbourhood of which but little opium is produced. The export from Smyrna in 1871, in which year the crop was very large, was 5650 cases, valued at £784,500.[2]

Turkey Opium as it is generally called in English trade, occurs in the form of rounded masses which according to their softness become more or less flattened or many-sided, or irregular by mutual pressure in the cases in which they are packed. There appears to be no rule as to their weight[3] which varies from an ounce up to more than 6lb.; from ½lb. to 2lb. is however the most usual. The exterior is covered with the remains of poppy leaves strewn over with the *Rumex* chaff before alluded to, which together make the lumps sufficiently dry to be easily handled. The consistence is such that the drug can be readily cut with a knife, or moulded between the fingers. The interior is moist

[1] Probably signifying *refuse,—that which comes out.*

[2] Consul Cumberbatch, *Trade Report for* 1871, presented to Parliament.

[3] The largest lump I have seen weighed 6lb. 6oz., being part of 65 packages which I examined 2nd July, 1873.—D. H.

d coarsely granular, varying in tint from a light chestnut to a ackish brown. Fine shreds of the epidermis of the poppy capsule e perceptible even to the naked eye, but are still more evident if the sidue of opium washed with water, is moistened with dilute chromic id (1 to 100). The odour of Turkey opium is peculiar, and though mmonly described as narcotic and unpleasant, is to many persons far om disagreeable. The taste is bitter.

The substances alleged to be used for adulterating Turkey opium are nd, pounded poppy capsules, pulp of apricots or figs, gum tragacanth or en turpentine. Bits of lead are sometimes found in the lumps, also ones and little masses of clay.

2. ***Egyptian Opium***—though not so abundant as formerly is still et with in European commerce. It usually occurs in hard, flattish kes about 4 inches in diameter covered with the remnants of a poppy af, but not strewn over with rumex-fruits. We have also seen it 873) as freshly imported, in a soft and plastic state. The fractured rface of this opium (when hard) is finely porous, of a dark liver-lour, shining here and there from imbedded particles of quartz or m, and reddish-yellow points (of resin?). Under the microscope a abundance of starch granules is sometimes visible. The morphine a sample from Merck amounted to 6 per cent.

According to Von Kremer who wrote in 1863,[1] there were then in pper Egypt near Esneh, Kenneh, and Siout, as much as 10,000 *ddan* (equal to about the same number of English acres) of land ultivated with the poppy from which opium was obtained in March, nd seed in April. Hartmann[2] states that the cultivation is carried n by the government, and solely for the requirement of the sanitary stablishments.

S. Stafford Allen in 1861 witnessed the collection of opium at Kenneh in Upper Egypt,[3] from a white-flowered poppy. An incision is made in the capsule by running a knife twice round it transversely, and the juice scraped off the following day with a sort of scoop-knife. The gatherings are collected on a leaf and placed in the sun to harden. The produce appeared extremely small and was said to be wholly used in the country.

Gastinel, director of the Experimental Garden at Cairo, and government inspector of pharmaceutical stores, has shown (1865) that the poppy in Egypt might yield a very good product containing 10 to 12 per cent. of morphine, and that the present bad quality of Egyptian opium is due to an over-moist soil, and a too early scarification of the capsule, whereby (not to mention wilful adulteration) the proportion of morphine is reduced to 3 or 4 per cent.

In 1872, 9636lb. of opium, value £5023, were imported into the United Kingdom from Egypt.

3. ***Persian Opium***—Persia, probably the original home of the tempful practice of opium-eating, cultivates the drug chiefly in the central provinces where according to Boissier, the plant grown to furnish it is *Papaver somniferum*, var. γ *album* (*P. officinale* Gm.) having ovate roundish capsules. Poppy heads from Persia which we

[1] *Aegypten. Forschungen über Land und Volk während eines 10 jährigen Aufenthaltes.* Leipzig, 1863.

[2] *Naturgeschichtl medicin. Skizze der Nilländer*, Berlin, 1866. 353.

[3] *Pharm. Journ.* iv. (1863) 199.

saw at the Paris Exhibition in 1867, had vertical incisions and contained white seeds.

The strongest opium called in Persia *Teriak-e-Arabistani* is obtained in the neighbourhood of Dizful and Shuster, east of the Lower Tigris. Good opium is likewise produced about Sari and Balfarush in the province of Mazanderan, and in the southern province of Kerman. The lowest quality which is mixed with starch and other matters, is sold in light brown sticks; it is made at Shahabdulazim, Kashan, and Kum.[1] A large quantity of opium appears to be produced in Khokan and Turkestan.

Persian opium is carried overland to China through Bokhara, Khokan and Kashgar;[2] but since 1864 it has also been extensively conveyed thither by sea, and it is now quoted in trade reports like that of Malwa, Patna, and Benares.[3] It is exported by way of Trebizond to Constantinople where it used to be worked up to imitate the opium of Asia Minor, and at the same time adulterated.[4] Since 1870, Persian opium which was previously rarely seen as such in Europe, has been imported in considerable quantity. It occurs in various forms, the most typical being a short rounded cone weighing 6 to 10 ounces. We have also seen it in flat circular cakes, 1¼lb. in weight. In both forms the drug was of firm consistence, a good opium-smell, and internally brown of a comparatively light tint. The surface was strewn over with remnants of stalks and leaves. Some of it had been collected with the use of oil as in Malwa (see p. 48), which was apparent from the greasiness of the cone, and the globules of oil visible when the drug was cut. The best samples of this drug as recently imported, have yielded 8 to 10·75 per cent. of morphine, reckoned on the opium in its moist state.[5]

Carles,[6] from a specimen which seems to have been adulterated with sugar, obtained 8·40 per cent. of morphine, and 3·60 of narcotine, the drug not having been previously dried.

Inferior qualities of Persian opium have also been imported. Some that was soft, black and extractiform afforded *undried* only 3 to ½ per cent. of morphine (Howard); while some of very pale hue in small sticks, each wrapped in paper, yielded no more than 0·2 per cent.! (Howard). For futher details, see p. 57.

4. *European Opium*—From numerous experiments made during the present century in Greece, Italy, France, Switzerland, Germany, England, and even in Sweden, it has been shown that in all these countries a very rich opium, not inferior to that of the East, can be produced.

[1] Polak, *Persien*, ii. (1865) 248, &c.

[2] Powell, *Economic Products of the Punjab*, i. (1868) 294.

[3] Thus in the *Trade Report* for Foochow, for 1870, addressed to Mr. Hart, Inspector-General of Customs, Pekin, is the following table:

		Malwa	Patna	Benares	Persian
Imports of Opium in 1867 . .	chests	2327	1673	724	300
,, ,, 1868 . .	,,	2460	1257	377	544
,, ,, 1869 . .	,,	2201	1340	410	593
,, ,, 1870 . .	,,	1849	1283	245	630

[4] Letter from Mr. Merck to Dr. F. 1863.

[5] Information kindly given us (9th June, 1873) by Mr. W. Dillworth Howard, of the firm of Howard and Sons, Stratford. A morphine manufacturer has no particular interest in ascertaining the amount of water in the opium he purchases. All he requires to know is the percentage of morphine which the drug contains. It is otherwise with the pharmaceutist, whose preparations have to be made with *dried opium*.

[6] *Journ. de Pharm.* xvii. (1873) 427.

ıost numerous attempts at opium-growing in Europe have
e in France. But although the cultivation was recommended
ongest terms by Guibourt,[1] who found in French opium the
ercentage of morphine yet observed (22·88 per cent.), it has
ome a serious branch of industry.
gier of Clermont-Ferrand has carried on the cultivation with
everance since 1844, and has succeeded in producing a very
ssated juice which he calls *Affium* and which is said to contain
[2] 10 per cent. of morphine. It is made up in cakes of 50
but is scarcely an article of wholesale commerce.[3]
careful and interesting scientific investigations relating to the
ı of opium in the neighbourhood of Amiens, were made by
in 1855 to 1862.[4] He found 14,725 capsules incised within
afford 431 grammes of milky juice, yielding 205 grammes
er cent.) of dry opium containing 16 per cent. of morphine.
ample of dried opium afforded 20 per cent. of morphine.
observed that the amount of morphine diminished when the
ry slowly dried,—a point of great importance deserving atten-
ndia. The peculiar odour of opium as observable in the
rug, is developed according to the same authority, by a kind of
on. Adrian[5] even suggests that morphine is formed only by
process, inasmuch as he could obtain none by exhausting
y capsules with acidulated alcohol, while capsules of the
yielded an opium rich in morphine.

st Indian Opium—The principal region of British India
hed for the production of opium is the central tract of the
omprising an area of about 600 miles in length, by 200 miles
It reaches from Dinajpur in the east, to Hazaribagh in the
l Gorakhpur in the north, and extends westward to Agra,
ading the flat and thickly-populated districts of Behar and
The amount of land here actually under poppy cultivation
ated in 1871–72 as 560,000 acres.
gion second in importance for the culture of opium consists
ad table-lands of Malwa, and the slopes of the Vindhya Hills,
ninions of the Holkar.
d these vast districts, the area under poppy cultivation is
vely small,[6] yet it appears to be on the increase. Stewart[7]
869) that the pla[illegible] is grown (principally for opium) through-
lains of the Punjab, but less commonly in the north-west. In
of the Biás east of Lahore, it is cultivated up to nearly
above the sea-level.
anufacture of opium in these parts of India is not under any
ı as in Hindustan. Most districts, says Powell (1868),[8]
the poppy to a certain extent, and produce a small quantity
rent opium for local consumption. The drug however is

le Pharm. xli. (1862) 184, 201.
s uniformity is ensured we know

t, *Officine*, ed. 8. 1872. 648.
e recorded in several pamphlets,
re are indebted to the author,
om the *Mém. de l'Acad. du dé-*
e la Somme and the *Mém. de*
Stanislas.

[3] *Journ. de Pharm.* vi. (1867) 222.

[4] So we may infer from the fact that of the 39,225 chests which paid duty to Government at Bombay in 1872, 37,979 were Malwa opium, the remaining 1246 being reckoned as from Guzerat.- *Statement of the Trade and Nav. of Bombay for* 1871–72, p. xv.

[7] *Punjab Plants*, Lahore, 1869. 10.

[8] Op. cit. i. 294.

prepared in the Hill States, and the opium of Kúlú (E. of Lahore), is of excellent quality, and forms a staple article of trade in that region. Opium is also produced in Nepal, Basáhír and Rámpúr, and at Doda Kashtwar in the Jammú territory.[1] It is exported from these districts to Yarkand, Khutan, Aksu, and other Chinese provinces,—to the extent in 1862 of 210 *maunds* (= 16,890lb). The Madras Presidency exports no opium at all.

The opium districts of Bengal,[2] are divided into two agencies, those of Behar and Benares, which are under the control of officials residing respectively at Patna and Ghazipur. The opium is a government monoply :—that is to say, the cultivators are under an obligation to sell their produce to the government at a price agreed on beforehand; at the same time it is wholly optional with them, whether to enter on the cultivation or not.

The variety of poppy cultivated is the same as in Persia, namely, *P. somniferum*, var. γ *album*. As in Asia Minor, a moist and fertile soil is indispensable.[3] The plant is liable to injury by insects, excessive rain, hail, or the growth on its roots of a species of *Orobanche*.

In Behar the sowing takes place at the beginning of November, and the capsules are scarified in February or March (March or April in Malwa). This operation is performed with a peculiar instrument, called a *nushtur*, having three or four two-pointed blades, bound together with cotton thread.[4] In using the *nushtur*, only one set of points is brought into use at a time, the capsule being scarified vertically from base to summit. This scarification is repeated on different sides of the capsule at intervals of a few days, from two to six times. In many districts of Bengal, transverse cuts are made in the poppy-head as in Asia Minor.

The milky juice is scraped off early on the following morning with an iron scoop, which as it becomes filled is emptied into an earthen pot carried by the collector's side. In Malwa a flat scraper is used which, as well as the fingers of the gatherer, is wetted from time to time with linseed oil to prevent the adhesion of the glutinous juice. All accounts represent the juice to be in a very moist state by reason of dew, which sometimes even washes it away; but so little is this moisture of the juice thought detrimental that, as Butter states,[5] the collectors in some places actually wash their scrapers in water, and add the washings to the collection of the morning!

The juice when brought home is a wet granular mass of pinkish colour; and in the bottom of the vessel in which it is contained, there collects a dark fluid resembling infusion of coffee, which is called *paséwá*. The recent juice strongly reddens litmus, and blackens metallic iron. It is placed in a shallow earthen vessel, which is tilted in such a manner that the *paséwá* may drain off as long as there is any of it to be separated. This liquor is set aside in a covered vessel. The residual mass is now exposed to the air, though never to the sun, and turned over every few days to promote its attaining the proper degree of

[1] At the base of the Himalaya, S. and S.E. of Kashmir.

[2] Much of what follows respecting Bengal opium is derived from a paper by Eatwell, formerly First Assistant and Opium Examiner in the Government Factory at Ghazipur.—*Pharm. Journ.* xi. (1852) 269, &c.

[3] It is said (1873) that the ground devoted to poppy-culture in Bengal is becoming impoverished and that the plant no longer attains its usual dimensions.

[4] For figures of the instrument, see *Pharm. Journ.* xi. (1852) 207.

[5] *Pharm. Journ.* xi. (1852) 209.

ryness, which according to the Benares regulations, allows of 30 per cent. f moisture. This drying operation occupies three or four weeks.

The drug is then taken to the Government factory for sale; previous o being sold it is examined for adulteration by a native expert, and s proportion of water is also carefully determined. Having been eceived into stock, it undergoes but little treatment beyond a thorough ixing, until it is required to be formed into globular cakes. This is ffected in a somewhat complicated manner, the opium being strictly of tandard consistence. First the quantity of opium is weighed out, and aving been formed into a ball is enveloped in a crust of dried poppy etals, skilfully agglutinated one over the other by means of a liquid alled *lévá*. This consists partly of good opium, partly of *paséwá*, and artly of opium of inferior quality, all being mixed with the washings f the various pots and vessels which have contained opium, and then vaporated to a thick fluid, 100 grains of which should afford 53 of dry esidue. These various things are used to form a ball of opium in the ollowing proportions:—

	seers	chittaks
Opium of standard consistence	1	7·50
,, contained in *lévá*		3·75
Poppy petals		5·43
Fine *trash*		0·50
	2	1·18 = { about 4lb. 3¼oz Avoirdupois

The finished balls usually termed *cakes*, which are quite spherical and ave a diameter of 6 inches, are rolled in *poppy trash* which is the name iven to the coarsely powdered stalks, capsules and leaves of the plant; hey are then placed in small dishes and exposed to the direct influence f the sun. Should any become distended, it is at once opened, the gas llowed to escape, and the cake made up again. After three days the cakes are placed, by the end of July, in frames in the factory where the air is allowed to circulate. They still however require constant watching and turning, as they are liable to contract mildew which has to be removed by rubbing in *poppy trash*. By October the cakes have become perfectly dry externally and quite hard, and are in condition to be packed in cases (40 cakes in each) for the China market which consumes the great bulk of the manufacture.

For consumption in India the drug is prepared in a different shape. It is inspissated by solar heat till it contains only 10 per cent. of moisture, in which state it is formed into square cakes of 2lb. each which are wrapped in oiled paper, or it is made into flat square tablets. Such a drug is known as *Abkári Opium*.

The Government opium factories in Bengal are conducted on the most orderly system. The care bestowed in selecting the drug, and in excluding any that is damaged or adulterated is such that the merchants who purchase the commodity rarely require to examine it, although permission is freely accorded to open at each sale any number of chests or cakes they may desire. In the year 1871–72 the number of chests sold was 49,695, the price being £139 per chest, which is £26 higher than the average of the preceding year. The net profit on each chest was £90.[1]

[1] *Statement exhibiting the moral and material progress and condition of India during the year* 1871–72,—Blue Book ordered to be printed 29th July, 1873. p. 19.

In Malwa the manufacture of opium is left entirely to private enterprise, the profit to Government being derived from an export duty of 600 rupees (£60) per chest.[1] As may readily be supposed, the drug is of much less uniform quality than that which has passed through the Bengal agencies, and having no guarantee as to purity it commands less confidence.

Malwa opium is not made into balls, but into rectangular masses, or bricks which are not cased in poppy petals; it contains as much as 95 per cent. of dry opium. Some opium sold in London as *Malwa Opium* in 1870 had the form of rounded masses covered with vegetable remains. It was of firm consistence, dark colour, and rather smoky odour. W. D. Howard obtained from it (*undried*) 9 per cent. of morphine. Other importations afforded the same chemist 4·8 and 6 per cent. respectively.

The chests of Patna opium hold 120 catties or 160lb. Those of Malwa opium 1 pecul or 133⅓lb.

The quantity of opium produced in India cannot be ascertained, but the amount exported[2] is accurately known. Thus from British India the exports in the year ending March 31, 1872, were 93,364 chests valued at £13,365,228. Of this quantity Bengal furnished 49,455 chests, Bombay 43,909 chests: they were exported thus:—

To China	85,470	chests
The Straits Settlements	7,845	,,
Ceylon, Java, Mauritius and Bourbon	38	,,
The United Kingdom	4	,,
Other countries	7	,,
Total	93,364	,,

The net revenue to the Government of India from opium in the year 1871–72 was £7,657,213.

6. *Chinese Opium*—China consumes not only nine-tenths of the opium exported from India, and a considerable quantity of that produced in Asia Minor, but the whole of what is raised in her own provinces. How large is this last quantity we shall endeavour to show.

The drug is mentioned as a production of Yunnan in a history of that province, of which the latest edition appeared in 1736. But it is only very recently that its cultivation in China has assumed such large proportions as to threaten serious competition with that in India.[3]

In a *Report upon the Trade of Hankow* for 1869, addressed to Mr. Hart, Inspector-General of Customs, Pekin, we find *Notes of a journey through the opium districts of Szechuen*, undertaken for the special purpose

[1] The revenue by this duty upon opium exported from Bombay in the year 1871–72, was £2,353,500.

[2] *Annual Statement of the Trade and Navigation of British India with foreign countries*, published by order of the Governor-General, Calcutta, 1872. 52.

[3] In the *Report on the Trade of Hankow for* 1869 addressed to Mr. Hart, Inspector-General of Customs, Pekin, it is stated—"The importation of opium is considerably short for the last two seasons, but this is not to be wondered at now that each opium-shopkeeper in this and the surrounding districts advertises native drug for sale."

W. H. Medhurst, British Consul at Shanghai, says—"The drug is now being so extensively produced by the Chinese upon their own soil as sensibly to affect the demand for the India-grown commodity."—*Foreigner in Far Cathay*, Lond. 1872. 20.

The quantity of opium exported from Bombay in 1871–72 was less by 1719 chests than that exported in 1870–71, the decrease being attributed to the present large cultivation in China.—*Statement of the Trade and Nav. of Bombay for* 1871–72, pp. xii.xvi.

information about the drug.[1] From these notes it appears timated crop of the province for 1869 was 4235 peculs). This was considered *small*, and the Szechuen opium sserted that 6000 peculs was a fair average. The same stimated the annual yield of the province of Kweichow at of Yunnan at 20,000 peculs, making a total of 41,000 peculs lb.

sul Markham states[2] that the province of Shensi likewise portant supplies. Mr. Edkins the well-known missionary ointed out from personal observation[3] the extensive cultiva- oppy in the north-eastern province of Shantung.

f very fair quality is now produced about Ninguta (lat. 44°) tern Manchuria, a region having a rigorous winter climate. ins of Newchwang who visited this district in 1871, reports m is inspissated in the sun until hard enough to be wrapped ves, and that its price on the spot is equal to about 1*s.* per

pium is said to be the best, then that of Yunnan. But isumers mostly regard home-grown opium as inferior in flavour, and only fit for use when mixed with the Indian

not be supposed that the growing of opium in China has ticed by the Chinese Government. Whatever may be the e sanction now accorded to this branch of industry, it was " prohibited, at least in some provinces, about ten years ago, f the prohibition being to stimulate the foreign importa- s at Shanghai in 1865, the importation of Benares opium was ,[5] being more than double that of the previous year, and m, very rarely seen before, was imported to the extent of besides about 70 peculs of Turkish.[6]

rowth of the trade in opium between India and China, the ures[7] will give some idea: value of exports in

£6,470,915. 1861-62—£9,704,972. 1871-72—£11,605,577.

ultivation in the south-west of China has been briefly Thorel,[8] from whose remarks it would appear to be exactly India. The poppy is white-flowered; the head is wounded -bladed knife, in a series of 3 to 5 vertical incisions, and the is scraped off and transferred to a small pot suspended at How the drug is finished off we know not. A Chinese s simply that the best opium is sun-dried. But little is known al and chemical properties. Thorel speaks of it as a soft sub- bling an extract. Dr. R. A. Jamieson[9] describes a sample sub-

to the French missionaries, of the poppy in the great echuen was hardly known as 1840.

ce. of Arts, Sept. 6, 1872.

a Herald, June 28, 1873.

I.M. Consuls in China, 1871

= 133⅓ lb.

[6] *Reports on the Trade at the Treaty Ports in China for* 1865. 125.

[7] Taken from the *Annual Statement of the Trade and Navigation of British India with foreign countries*, published by order of the Governor-General, Calcutta, 1872. 199.

[8] *Notes médicales du voyage d'exploration du Mékong et de Cochinchine*, Paris, 1870. 32.

[9] *Report on the Trade of Hankow*, before-quoted.

mitted to him as a flat cake enveloped in the sheathing petiole of bamboo; externally it was a blackish-brown, glutinous substance, dry and brittle on the outside. It lost by drying 18 per cent. of water, and afforded upon incineration 7·5 per cent. of ash. In 100 grains of the (undried) drug, there were found 5·9 of morphine, and 7·5 of narcotine. (See also p. 58.)

The Chinese who prepare opium for use by converting it into an aqueous extract which they smoke, do not estimate the value of the drug according to its richness in morphine, but by peculiarities of aroma and degree of solubility. In China the preparation of opium for smoking is a special business, not beneath the notice even of Europeans.[1]

Description—The leading characteristics of each kind of opium have been already noticed. The following remarks bear chiefly on the microscopic appearances of the drug.

As will be presently shown, a more or less considerable part of the drug consists of peculiar substances which are mostly crystallizable and are many of them present in a crystalline state in the drug itself. All kinds of opium appear more or less crystalline when a little in a dry state is triturated with benzol and examined under the microscope. The forms are various: opium from Asia Minor exhibits needles and short imperfect crystals usually not in large quantity, whereas Indian and still more Persian opium is not only highly crystalline but shows a variety of forms which become beautifully evident when seen by polarized light. In several kinds large crystals occur which are doubtless sugar, either intentionally mixed or naturally present. The crystals seen in opium are not however sufficiently developed to warrant positive conclusions as to their nature, besides which the opium constituents when pure are capable under slightly varied circumstances of assuming very different forms. Hence the attempt to obtain from solutions crystals which shall be comparable with those of the same substances in a state of purity often fails. Some interesting observations in this direction were made by Deane and Brady in 1864-5.[2]

All opium has a peculiar narcotic odour and a sharp bitter taste.

Chemical Composition—Poppy-juice like analogous vegetable fluids is a mixture of several substances in variable proportion. With the commoner substances which constitute the great bulk of the drug we are not yet sufficiently acquainted.

In the first place (independently of water) there is found mucilage distinct from that of gum arabic, also pectic matter, and albumin. These bodies, together with unavoidable fragments of the poppy-capsules, probably amount on an average to more than half the weight of the opium.[3]

In addition to these substances, the juice also contains sugar in solution,—in French opium to the extent of 6½ to 8 per cent.: according to Decharme it is uncrystallizable. Sugar also exists in other opium, but whether always naturally has not been determined.

[1] In 1870, a British firm at Amoy opened an establishment for preparing opium for the supply of the Chinese in California and Australia.

[2] *Pharm. Journ.* vi. 234: vii. 183. with 4 beautiful plates representing the crystallizations from extract and tincture of opium as well as from the pure opium constituents. When the juice of the poppy is prevented from rapid drying by the addition of a little glycerin, crystals are developed in it.

[3] Flückiger, in *Pharm. Journ.* x. (1869) 208.

Fresh poppy-juice contains in the form of emulsion, wax, pectin, albumin and insoluble calcareous salts. When good Turkey opium is treated with water these substances remain in the residue to the extent of 6 to 10 per cent.

Hesse has isolated the *wax* by exhausting the refuse of opium with boiling alcohol and a little lime. He thus obtained a crystalline mass from which he separated by chloroform *Palmitate* and *Cerotate of Cerotyl*, the former in the larger proportion.

Respecting the colouring matter and an extremely small quantity of a volatile body with pepper-like odour, we know but little. After the colouring matter has been precipitated from an aqueous solution of opium by lead acetate, the liquid becomes again coloured by exposure to the air. As to the volatile body, it may be removed by acetone or benzol, but has not yet been isolated.

The salts of inorganic bases, chiefly of calcium, magnesium and potassium, contain partly the ordinary acids such as phosphoric and sulphuric, and partly an acid peculiar to the poppy.

Good opium of Asia Minor dried at 100° C. yields 4 to 8 per cent. of ash.

Poppy-juice contains neither starch nor tannic acid, the absence of which easily-detected substances affords one criterion for judging of the purity of the drug.

The proportion of water in opium is very variable. In drying Turkey opium previous to pulverization and for other pharmaceutical purposes, the average loss is about 12½ per cent.[1] Bengal opium which resembles a soft black extract is manufactured so as to contain 30 per cent. of water.

As the active constituents of opium, or at all events the morphine, can be completely extracted by cold water, the proportion of soluble matter is of practical importance. In good opium of Asia Minor previously dried, the extract (dried at 100° C.) always amounts to between 55 and 66 per cent.,—generally to more than 60,—thus affording in many instances a test of the pureness of the drug. Dried Indian opium yields from 60 to 68 per cent. of matter soluble in cold water.[2]

The peculiar constituents of opium are of basic, acid, or neutral nature. Some of these substances were observed in opium as early as the 17th or 18th century and designated *Magisterium Opii*. Bucholz in 1802 vainly endeavoured to obtain a salt from the extract by crystallization. In 1803 however, Charles Derosne, an apothecary of Paris, in diluting a syrupy aqueous extract of opium, observed crystals of the substance now called *Narcotine*, which he prepared pure. He believed that the same body was obtained by precipitating the mother liquor with an alkali, but what he so got was morphine. It is needless to pursue the further researches of Derosne. Ingenious as they were it was reserved for Friedrich Wilhelm Adam Sertürner, apothecary of Einbeck in Hanover (*nat.* 1783, *ob.* 1841) to discover their true interpretation.

Sertürner had been engaged since 1805 with the chemical investigation of opium, and in 1816 he summarized his results in the statement

[1] From the laboratory accounts of Messrs. Allen and Hanburys, London, by which it appears that 200lb. of Turkey opium dried at various times in the course of 10 years lost in weight 25¼lb.

[2] Calculated from official statements given by Eatwell in the paper quoted at p. 48

that he had enriched science (we now translate his own words[1])—"not only with the knowledge of a remarkable new vegetable acid [*Mekonsäure* (meconic acid) which he had made known as *Opiumsäure* in 1806], but also with the discovery of a new alkaline salifiable base, *Morphium*, one of the most remarkable substances and apparently related to ammonia." Sertürner in fact distinctly recognized the basic nature and the organic constitution of morphium (now called *Morphine, Morphia*, or *Morphinum*) and prepared a number of its crystalline salts. He likewise demonstrated the poisonous nature of these substances by experiments on himself and others. Lastly he pointed out, though very incorrectly, the difference between morphine and the so-called *Opium-salt* (Narcotine) of Derosne. It is possible that this latter chemist may have had morphine in his hands at the same time as Sertürner, or even earlier. This honour seems also due to Séguin whose paper "*Sur l'Opium*" read at the Institute, December 24, 1804, was, strange to say, not published till 1814.[2] To Sertürner however undoubtedly belongs the merit of first making known the existence of organic alkalis in the vegetable kingdom,—a series of bodies practically interminable. As to opium, it still remains after nearly seventy years a *nidus* of new substances.[3]

Solutions of morphine in acids or in alkalis rotate the plane of polarization to the left.

The morphine in opium is combined with meconic acid and is therefore easily soluble in water.[4] The *Narcotine* is present in the free state and can be extracted by chloroform, boiling alcohol, benzol, ether, or volatile oils,[5] but not by water. It dissolves in 3 parts of chloroform, in 20 of boiling alcohol, in 21 of benzol, in 40 of boiling ether. Its alkaline properties are very weak, and it does not affect vegetable colours. If we examine opium by the microscope we cannot at once detect the presence of narcotine, but if first moistened with glycerin, numerous large crystals may generally be found after the lapse of some days. If the opium has been previously exhausted with benzol or ether, in order to remove the narcotine, no such crystals will be formed. Hence it follows that narcotine pre-exists in an amorphous state.

By decomposition with sulphuric acid, narcotine yields *Cotarnine*, an undoubted base, together with *Opianic Acid* and certain derivatives of the latter.

The discovery of another base, *Codeine*, was made in 1832 by Robiquet. It dissolves in 17 parts of boiling water forming a highly alkaline solution which perfectly saturates acids, and exhibits in polarized light a levogyre power. Codeine is also readily soluble at ordinary temperatures in 7 parts of amylic alcohol, and in 11 of benzol.

The codeine of commerce is in very large crystals containing 2 atoms = 5·66 per cent. of water. By crystallization from ether the alkaloid may be obtained in small anhydrous crystals.

Since 1832 other alkaloids have been found in opium as may be seen in the following table, which includes all the sixteen now known.

[1] Gilbert's *Annalen der Physik*. xxv. (1817) 57.

[2] *Annales de Chimie*, xcii. (1814) 225.

[3] The Institut de France on the 27th June, 1831, awarded to Sertürner a prize of 2000 francs—"pour avoir reconnu la nature alcaline de la morphine, et avoir ainsi ouvert une voie qui a produit de grandes découvertes médicales."

[4] There are exceptional cases in which it is asserted that water does *not* take up the whole amount of morphine.

[5] In large crystals by means of oil of turpentine.

TABLE *showing the* NATURAL ALKALOIDS OF OPIUM *and a few of their Artificial Derivatives.*

...ERED BY		C	H	N	O
1844	COTARNINE Formed by oxidizing narcotine; soluble in water.	12	13	1	3
871	**1. HYDROCOTARNINE** Crystallizable, alkaline, volatile at 100°.	12	15	1	3
...sen and ..., 1871	APOMORPHINE From morphine, by hydrochloric acid. Colourless, amorphous, turning green by exposure to air; emetic.	17	17	1	2
1871	DESOXYMORPHINE	17	19	1	2
..., 1816	**2. MORPHINE** Crystallizable, alkaline, levogyre.	17	19	1	3
... and Thi-...ry, 1835	**3. PSEUDOMORPHINE** Crystallizes with H^2O; does not unite even with acetic acid.	17	19	1	4
...sen and ...de, 1871	APOCODEINE From codeine by chloride of zinc; amorphous, emetic.	18	19	1	2
1871	DESOXYCODEINE	18	21	1	2
..., 1832	**4. CODEINE** Crystallizable, alkaline, soluble in water.	18	21	1	3
...sen and ..., 1868	NORNARCOTINE	19	17	1	7
...ery, 1835	**5. THEBAINE** Crystallizable, alkaline, isomeric with buxine.	19	21	1	3
870	THEBENINE	19	21	1	3
870	THEBAICINE From thebaine or thebenine by hydrochloric acid.	19	21	1	3
871	**6. PROTOPINE** Crystallizable, alkaline.	20	19	1	5
...sen and ..., 1868	METHYLNORNARCOTINE	20	19	1	7
871	DEUTEROPINE Not yet isolated.	20	21	1	5
870	**7. LAUDANINE** An alkaloid which, as we ... its salts, forms large crystals; turns orange by hydrochloric acid.	20	25	1	4
870	**8. CODAMINE** Crystallizable, alkaline; can be sublimed; becomes green by nitric acid	20	25	1	4
848	**9. PAPAVERINE** Crystallizable, also its hydrochlorate; sulphate in sulphuric acid precipitated by water	21	21	1	4
865	**10. RHŒADINE** Crystallizable, not distinctly alkaline; can be sublimed; occurs also ... *Rhœas.*	21	21	1	6
865	RHŒAGENINE From rhœadine; crystallizable, alkaline	21	21	1	6
..., 1871	DIMETHYLNORNARCOTINE	21	21	1	7
1870	**11. MECONIDINE** Amorphous, alkaline, melts at 58°, not stable, the salts also easily altered.	21	23	1	4
Smith, 1864	**12. CRYPTOPINE** Crystallizable, alkaline; salts tend to gelatinize; hydrochlorate crystallizes in tufts.	21	23	1	5
1871	**13. LAUDANOSINE** Crystallizable, alkaline.	21	27	1	4
... 1866	**14. NARCOTINE** Crytallizable, not alkaline; salts not stable.	22	23	1	7
1870	**15. LANTHOPINE** Microscopic crystals not alkaline, sparingly soluble in hot or cold spirit of wine, ether or benzol	23	25	1	4
... 182	**16. NARCEINE**[1] Crystallizable (as a hydrate), readily soluble in boiling water or in alkalis, levogyre	23	29	1	9

[1] Hinterberger described as a peculiar alkaloid, *Opianine*. Dr. Hesse has lately examined Hinterberger's specimen ... By a letter from him, dated 5 Oct. 1873, we learn that he regards its existence as a definite substance extremely ... F. A. F.

A large number of derivatives of several among them have been prepared, of which we point out a few in smaller type. The molecular constitution of these opium alkaloids being not yet thoroughly settled we add only their empirical formulæ, which however exhibit unmistakeable connections.

Papaverosine discovered by Deschamps in poppy-heads (p. 40) can hardly be absent from opium. In some points it appears to resemble cryptopine.

Among the peculiar non-basic constituents of opium, the first to call for notice is *Meconic Acid*, $C^7H^4O^7$, discovered, as already observed, by Sertürner in 1805. It is distinguished by the red colour which it produces with ferric salts. It dissolves in 4 parts of boiling water, but immediately gives off CO^2, and the remaining solution instead of depositing micaceous crystalline scales of meconic acid, yields on cooling (but best after boiling with hydrochloric acid) hard granular crystals of *Comenic Acid*, $C^6H^4O^5$.

Lactic Acid was discovered by T. and H. Smith in the opium-liquors produced in the manufacture of morphine. These chemists regarded it as a peculiar body, and under the name of *Thebolactic Acid*, exhibited it together with its copper and morphine salts at the London International Exhibition of 1862. Its identity with ordinary lactic acid was ascertained by Stenhouse (whose experiments have not been published) and also by J. Y. Buchanan.[1] T. and H. Smith consider it to be a regular constituent of Turkey opium; they obtained it as a calcium-salt to the amount of about 2 per cent., and have prepared it in this form and in a pure state to the extent of over 100lb. In our opinion it is not an original constituent of poppy-juice.

In the year 1826, Dublanc[2] observed in opium a peculiar substance having neither basic nor acid properties which was afterwards (1832) prepared in a state of purity by Couerbe. It has been called *Opianyl* (by Couerbe *Meconine*). It has the composition $C^{10}H^{10}O^4$ and crystallizes in six-sided prisms which fuse under water at 77° C. or *per se* at 110°, and distil at 155°; it dissolves in about 20 parts of boiling water from which it may be readily crystallized. Opianyl may be formed by heating narcotine with nitric acid.

Proportion of peculiar constituents—The substances described in the foregoing section exist in opium in very variable proportion; and as it is on their presence, but especially that of morphine, that the value of the drug depends, the importance of exact estimation is evident.

Opium whether required for analysis or for pharmaceutical preparations has to be taken *exclusively in the dry state*. The amount of water it contains is so uncertain that the drug must be reduced to a fixed standard by complete desiccation at 100° C., before any given weight is taken.

Morphine—Guibourt[3] who analysed a large number of samples of opium, and whose skill and care in such research are not disputed, obtained from a sample of French opium produced near Amiens, 22·88

[1] *Berichte d. Deutsch. Chem. Gesellsch. zu Berlin*, iii. (1870) 182.

[2] *Annales de Chimie et de Physique*, xlix. (1832) 5—20.—The paper was read before the Acad. de Méd., 13th May, 1826.

[3] *Mémoire sur le dosage de l'Opium et sur la quantité de morphine que l'opium doit contenir*, Paris, 1862.

er cent. of morphine crystallized from spirit of wine. This percentage has not to our knowledge been ever exceeded. From another specimen produced in the same district he got 21·23 per cent., from third 20·67. The lowest percentage from a French opium was 14·96, -in each case reckoned on material previously dried.

Chevallier extracted from opium grown by Aubergier at Clermont in the centre of France, 17·50 per cent. of morphine. Decharmes from French opium obtained 17·6 per cent., and Biltz from a German opium 20 per cent. Opium produced in Würtemberg sent to the Vienna Exhibition of 1873 afforded Hesse 12 to 15 per cent. of morphine; and opium from Silesia 9 to 10 per cent.[1]

A pure American opium collected in the State of Vermont yielded Procter 15·75 per cent. of morphine and 2 per cent. of narcotine.[2]

The opium of Asia Minor furnishes very nearly the same proportions of morphine as that of Europe. The maximum recorded by Guibourt is 21·46 per cent. obtained from a Smyrna opium sold in Paris. The mean yield of 8 samples of opium sent by Della Sudda of Constantinople to the Paris Exhibition of 1855 was 14·78 per cent. The mean percentage of morphine afforded by 12 other samples of Turkey opium obtained from various sources was 14·66.

Chevallier[3] states that Smyrna opium of which several cases were received by Merck of Darmstadt in 1845, afforded 12 to 13 per cent. of pure morphine reckoned upon the drug in its *fresh and moist state.*

Fayk Bey[4] analysed 92 samples of opium of Asia Minor and found that half the number yielded more than 10 per cent. of morphine. The richest afforded 17·2 per cent.

From the foregoing statements we are warranted in assuming that *good* Smyrna opium deprived of water ought to afford 12 to 15 per cent. of morphine, and that if the percentage is less than 10, adulteration may be suspected.

Egyptian opium has usually been found very much weaker in morphine than that of Asia Minor. A sample sent to the Paris Exhibition of 1867 and presented to one of us by Figari Bey of Cairo, afforded us 5·8 per cent. of morphine and 8·7 of narcotine.

Persian opium appears extremely variable, probably in consequence of the practice of combining it with sugar and other substances. It is however sometimes very good. Séput[5] obtained from four samples the respective percentages of 13·47, 11·52, 10·12, 10·08 of morphine, the opium being free from water. Mr. Howard as already stated (p. 46) extracted from Persian opium, not previously dried, from 8 to 10·75 per cent. of morphine.

East Indian opium is remarkable for its low percentage of morphine, a circumstance which we think is attributable in part to climate and in part to a method of collection radically defective. It is scarcely conceivable that the long period during which the juice remains in a wet state,—always three to four weeks,—does not exercise a destructive action on its constituents.

[1] Schroff, *Ausstellungsbericht, Arzneiwaaren*, p. 31.
[2] *Am. Journ. of Pharm.* xviii. (1870) 124.
[3] *Notice historique sur l'opium indigène*, Paris, 1852.
[4] *Monographie des Opiums de l'Empire Ottoman envoyés à l'Exposition de Paris*, 1867.
[5] *Journ. de Pharm.* xxxix. (1861) 163.

According to Eatwell[1] the percentage of morphine in the samples of Benares opium officially submitted for analysis gave the following averages:—

1845-46	1846-47	1847-48	1848-49
2·48	2·38	2·20	3·21

The same observer has recorded the results of the examination of freshly collected poppy-juice, which in three instances afforded respectively 1·4, 3·06, and 2·89 per cent. of morphine, reckoned on the material deprived of water; but the conditions under which the experiments were made appear open to great objection.[2]

Such very low results are not always obtained from East Indian opium. In a sample from Khandesh furnished by the Indian Museum, we found 6·07 of morphine. Solly from the same kind obtained about 7 per cent.

Patna Garden Opium which is the sort prepared exclusively for medicinal use, afforded us 8·6 per cent. of purified morphine and 4 per cent. of narcotine.[3] Guibourt obtained from such an opium 7·72 per cent. Christison from a sample sent to Duncan of Edinburgh in 1830,[4] 9·50 per cent. of hydrochlorate of morphine.

Samples from the Indian Museum placed at our disposal by Dr. J. Forbes Watson gave us the following percentages of morphine:—*Medical (Indian) Opium*, 1852–53, portion of a square brick, 4·3; *Garden Behar Opium*, 4·6; *Abkári Provision Opium, Patna*, No. 5380, 3·5; *Sind Opium*, No. 28, 3·8; *Opium, Hyderabad, Sind*, 3·2 (and 5·4 of narcotine); *Malwa Opium*, 6·1.

With regard to the percentage of morphine in *Chinese Opium*, the following data have been obligingly furnished to us by Mr. T. W. Sheppard, F.C.S., Opium Examiner to the Benares Opium Agency, of analyses made by himself from samples of the drug procured in China by Sir R. Alcock:—Szechuen opium, 2·2; Kweichow, 2·5; Yunnan, 4·1; Kansu, 5·1 per cent. Mr. S. informs us that Dr. Eatwell obtained in 1852 from Szechuen opium 3·3, and from Kweichow opium 6·1[5] per cent.—the opium in all instances being reckoned as *dry*. The samples examined by Mr. S. contained 86 to 95 per cent. of dry opium, and yielded (undried) 36 to 53 per cent. of extract soluble in cold water. The proportion of morphine in the sample of Chinese opium analysed by Dr. Jamieson (p. 51) was nearly 7·2 per cent. calculated on the dry drug.

Pseudomorphine—occurs only in very small quantity. Hesse found it in some sorts of opium to the extent of 0·02 per cent,—in others still less.

Codeine—has been found in Smyrna, French and Indian opium, but only to the extent of $\frac{1}{5}$ to $\frac{2}{5}$ per cent. T. and H. Smith give the proportion in Turkey opium as 0·3 per cent.[6]

Thebaine—which has likewise been obtained from French opium, amounts in Turkey opium according to Merck to about 1 per cent. In the latter sort T. and H. Smith found only about 0·15 per cent., but of

[1] *Pharm. Journ.* xi. (1852) 361.

[2] In one case the juice was allowed to stand in a basin from 23rd Feb. to 7th May, being "occasionally stirred"!

[3] This drug made in 1838 came from the Apothecary-General, Calcutta, and was presented by Christison to the Kew Museum. It is in rectangular tablets $2\frac{1}{8}$ inches square and $\frac{3}{4}$ of an inch thick, cased in wax.

[4] The actual specimen is in the Kew Museum.

[5] This sample, the richest of all in morphine, is noted as of "*2nd quality*."

[6] *Pharm. Journ.* vii. (1866) 183.

Papaverine—in the same drug, 1 per cent.

Narcotine—exists in opium in widely different proportions and often in considerable abundance. Thus Schindler obtained from a Smyrna opium yielding 10·30 per cent. of morphine, 1·30 per cent. of narcotine. Biltz analysed an oriental opium which afforded 9·25 per cent. of morphine and 7·50 of narcotine. Reveil obtained from Persian opium not rich in morphine, from half as much to twice as much narcotine as morphine. The utmost of narcotine was 9·90 per cent. We have found in German opium of indubitable purity[1] 10·9 per cent. of narcotine.

East Indian opium was found by Eatwell always to afford more narcotine than morphine,—frequently twice as much. The sample from Khandesh referred to on the opposite page, afforded us 7·7 per cent. of pure narcotine.

French opium collected from the *Pavot œillet* sometimes affords neither narcotine, thebaine, or narceine.[2]

Narceine—Of this substance Couerbe found in opium 0·1 per cent.; T. and H. Smith 0·02 and Schindler 0·71.

Cryptopine—exists in opium in very small proportion. T. and H. Smith state that since the alkaloid first came under their notice, they have collected of it altogether about 5 ounces in the form of hydrochlorate, and this small quantity in operating on many thousands of pounds of opium. But they by no means assert that the whole of the cryptopine was obtained.

Rhœadine—is also found only in exceedingly minute quantity.

Meconic Acid—If the average amount of morphine in opium be estimated at 15 per cent., and the alkaloid be supposed to exist as a tribasic meconate, it would require for saturation 3·4 per cent. of meconic acid. Wittstein obtained rather more than 3 per cent., T. and H. Smith 4 per cent., and Decharmes 4·33. The quantity of acid required to unite with the other bases assuming them to exist as salts can be but extremely small.

Estimation of Morphine in Opium—The practical valuation of opium turns in the first instance upon the estimation of the water present in the drug (p. 53) and in the second upon the proportion which the latter contains of morphine.[3]

The first question is determined by exposing a known quantity of the drug divided into small slices or fragments to the heat of a water-bath until it cease to lose weight.

For the estimation of the morphine many processes have been devised, but none is perfectly satisfactory. That which we recommend is thus performed:—Take of opium previously dried at 100° C., 7 to 10 grammes, mix it with thrice its weight of coarsely-powdered pumice, and pack the mixture in a percolation-tube. Then remove by boiling ether the narcotine together with wax and colouring matter. The residue should

[1] Collected by Biltz and obligingly placed at my disposal by his son.—F. A. F.

[2] The statement of Biltz that an opium collected by himself from poppies grown at Erfurt afforded 33 per cent. of narcotine is so contrary to the experience of all other chemists that we cannot accept it as certain. The same must be said of Christison's discovery of an opium yielding 8 per cent. of codeine, and of Mulder's assertion respecting an opium giving 6 to 13 per cent. of narceine.

[3] In selecting a sample for analysis, care should be taken that it fairly represents the bulk of the drug. We prefer to take a little piece from each of several lumps, mix them in a mortar, and weigh from the mixed sample the required quantity.

be next moistened (it may remain in the tube) with a very little spirit of wine (0·822), and exhausted with water. The solution is usually a little acid: if otherwise, the water used should be very slightly acidulated with acetic acid. The solution should be equal to about 20 times the weight of the opium; it is to be mixed with ammonia, used as little in excess as possible. After a repose of a day or two, the morphine will be found in crystals attached to the sides and bottom of the glass. It may be dried and weighed as *crude morphine*, yet ought to be re-crystallized from boiling spirit of wine (0·822), at least once.

There are three principal difficulties in this process:—1. It is not easy to remove the whole amount of narcotine and wax. 2. It is even less easy to extract the morphine with as little water as one would desire; and by using much water, the bulk of the solution is inconveniently increased and has then to be reduced by evaporation, which is better avoided. 3. The purification of the crude morphine is necessary yet occasions inevitable loss.

These sources of error should be kept in view and avoided as much as possible.

Commerce—By official statistics it appears that the quantity of opium imported into the United Kingdom in 1872 was 356,211lb., valued at £361,503. The imports from Asiatic and European Turkey are stated in the same tables thus:—

1868	1869	1870	1871	1872
317,133lb.	203,546lb.	276,691lb.	492,855lb.	325,572lb.

It is thus evident that the drug used in Great Britain is chiefly Turkish. The import of opium from Persia has been very irregular. In 1871, 21,894lb. are reported as received from that country; in 1872, none.

Except that a little Malwa opium has occasionally been imported, it may be asserted that the opium of India is entirely unknown in the English market, and that none of it is to be found even in London in the warehouse of any druggist.

Uses—Opium possesses sedative powers which are universally known. In the words of Pereira, it is the most important and valuable medicine of the whole Materia Medica; and we may add, the source by its judicious employment of more happiness and by its abuse of more misery than any other drug employed by mankind.

Adulteration—The manifold falsifications of opium have been already noticed, and the method by which its most important alkaloid may be estimated has been pointed out. Moreover as already stated, neither tannic acid nor starch ever occur in genuine opium; and the proportion of ash left upon the incineration of a good opium does not exceed 4 to 8 per cent. of the dried drug. Another criterion is afforded by the amount soluble in cold water which ought to exceed 55 per cent. reckoned on dry opium. Finally, if we are correct, the gum contained in pure opium is distinct from gum arabic, being precipitable by neutral acetate of lead. If we exhaust with water opium falsified with gum arabic, the mucilage peculiar to opium will be precipitated by neutral acetate of lead, the liquid separated from the precipitate, will still contain the gum arabic which may be thrown down by alcohol. If gum is present to some extent, an abundant precipitate is produced.

CRUCIFERÆ.

SEMEN SINAPIS NIGRÆ.

'ack, Brown or Red Mustard; F. *Moutarde noire ou grise;* G. *Schwarzer Senf.*

Botanical Origin—*Brassica nigra* Koch (*Sinapis nigra* L.). Black ustard is found wild over the whole of Europe excepting the extreme ›rth. It also occurs in Northern Africa, Asia Minor, the Caucasian gion, Western India, as well as in Southern Siberia. By cultivation, hich is conducted on a large scale in many countries (as Alsace, ohemia, Holland, England and Italy), it has doubtless been diffused ırough regions where it did not anciently exist. It has now become aturalized both in North and South America.

History—Mustard was well known to the ancients. Theophrastus nentions it as Νάπυ,—Dioscorides as Νάπυ or Σίνηπι. ·Pliny notices hree kinds which have been referred by Fée[1] to *Brassica nigra* Koch, *B. alba* Hook. f. et Th., and to a South European species, *Diplotaxis rucoides* DC. (*Sinapis erucoides* L.). The use of mustard seems up to this period to have been more medicinal than dietetic. But from an edict of Diocletian, A.D. 301[2] in which it is mentioned along with alimentary substances, we must suppose it was then regarded as a condiment at least in the eastern parts of the Roman Empire.

In Europe during the middle ages mustard was a valued accompaniment to food, especially to the salted meat which constituted a large portion of the diet of our ancestors during the winter.[3] In household accounts of the 13th and 14th centuries, mustard under the name of *Senapium* is of constant occurrence.

Mustard was then cultivated in England, but not as it would seem very extensively. The price of the seed between A.D. 1285 and 1395 varied from 1*s.* 3*d.* to 6*s.* 8*d.* per quarter, but in 1347 and 1376 it was as high as 15*s.* and 16*s.*[4] In the accounts of the abbey of St. Germain-des-Prés in Paris, commencing A.D. 800, mustard is specifically mentioned as a regular part of the revenue of the convent lands.[5]

Production—Mustard is grown in England only on the richest alluvial soils, and chiefly in the counties of Lincolnshire and Yorkshire. Very good seed is produced in Holland.

Description—The pod of *Brassica nigra* is smooth, erect, and closely pressed against the axis of the long slender raceme. It has a strong nerve on each of its two valves and contains in each cell from 4 to 6 spherical or slightly oval seeds. The seeds are about $\frac{1}{24}$ of an inch in diameter and $\frac{1}{50}$ of a grain in weight; they are of a dark reddish-brown. The surface is reticulated with minute pits, and often more or less covered with a whitish pellicle which gives to some seeds a grey colour.[6]

[1] *Botanique et Matière Méd. de Pline*, ii. (1831) 446.

[2] Mommsen in *Berichte. . . d. Gesell. d. Wissenschaften zu Leipzig*, 1851. 1—80.

[3] Enclosed pasture land in England was rare, and there was but scanty provision for preserving stock through the winter, root crops being unknown. Hence in November there was a general slaughtering of sheep and oxen, the flesh of which was salted for winter use.

[4] Rogers, *Hist. of Agriculture and Prices in England*, i. (1866) 223.

[5] Guérard, *Polyptique de l'Abbé Irminon*, Paris, i. (1844) 715.

[6] The grey colour of the seed which is attributed to rain during the ripening, is very detrimental to its value. The great aim of the grower is to produce seed of a bright reddish brown, with no grey seed intermixed.

The testa which is thin, brittle and translucent encloses an exalbuminous embryo having two short cotyledons folded together longitudinally and forming a sort of trough in which the radicle lies bent up. The embryo thus coiled into a ball completely fills the testa; the outer cotyledon is thicker than the inner, which viewed in transverse section seems to hold the radicle as a pair of forceps. The seeds when pulverized have a greenish yellow hue. Masticated they have for an instant a bitterish taste which however quickly becomes pungent. When triturated with water they afford a yellowish emulsion emitting a pungent acrid vapour which affects the eyes, and has a strong acid reaction. The seeds powdered dry have no such pungency. When the seeds are triturated with solution of potash, the pungent odour is not evolved; nor when they are boiled in water. Neither is the acridity developed on triturating them with alcohol, dilute mineral acids, or solution of tannin, or even with water when they have been kept in powder for a long time.

Microscopic Structure—The whitish pellicle already mentioned, which covers the seed, is made up of hexagonal tabular cells. The epidermis consists of one row of densely packed brown cells, radially elongated and having strong lateral and inner walls. Their outer walls on the other hand are thin and not coloured they are not clearly obvious when seen under oil, but swell up very considerably in presence of water, emitting mucilage. Seeds immersed in water become therefore covered with a glossy envelope, levelling down the superficial inequalities, so that the wet seed appears smooth. The tissue of the cotyledons exhibits large drops of fatty oil and granules of albumin.

Chemical Composition—By distilling brown mustard with water, the seed having been previously macerated, the pungent principle, *Essential Oil of Mustard*, is obtained.

The oil, which has the composition C^4H^5NS or $\left.\begin{matrix} C\,N \\ C^3H^5 \end{matrix}\right\} S$ (allyl sulphocyanide), boils at 148° C.; it has a sp. gr. of 1·017, no rotatory power, and is soluble without coloration or turbidity in three times its weight or more of cold strong sulphuric acid. To this oil is due the pungent smell and taste of mustard and its inflammatory action on the skin. As already pointed out, mustard oil is not present in the dry seeds but is produced only after they have been comminuted and mixed with water, the temperature of which should not exceed 50° C.

The remarkable reaction which gives rise to the formation of mustard oil was explained by Will and Körner in 1863. They obtained from mustard a crystallizable substance, then termed *Myronate of potassium*, now called *Sinigrin*. It is to be regarded, according to the admirable investigations of these chemists, as a compound of

Sulphocyanide of allyl or mustard oil .	C^4	H^5	NS	
Bisulphate of potassium		H	KS	O^4
Sugar (dextroglucose)	C^6	H^{12}		O^6

so that the formula $C^{10}\ H^{18}\ KNS^2\ O^{10}$ is that of sinigrin. It does in fact split into the above-mentioned three substances when dissolved in water and brought into contact with *Myrosin*.

s albuminous body discovered by Bussy in 1839, but the com-
ı of which has not been made out, likewise undergoes a certain
osition under these circumstances. Sinigrin may likewise be
osed by alkalis and, according to Ludwig and Lange, by silver
These chemists obtained sinigrin from the seeds in the pro-
of 0·5 per cent.; Will and Körner got 0·5 to 0·6 per cent. The
ion of the substance is therefore attended with great loss, as the
ım yield of volatile oil, 0·42 per cent. indicates 2·36 of potassium
ıte.

aqueous solution of myrosin coagulates at 60° C. and then
s inactive: hence mustard seed which has been heated to 100° C.
been roasted yields no volatile oil, nor does it yield any if
ed and introduced at once into boiling water. The proportion of
ı in mustard has not been exactly determined. The total amount
ogen in the seed is 2·9 per cent. (Hoffmann) which would corre-
o 18 per cent. of myrosin, supposing the proportion of nitrogen in
bstance to be the same as in albumin, and the total quantity of
n to belong to it. Sometimes black mustard contains so little of
an emulsion of white mustard requires to be added in order to
all the volatile oil it is capable of yielding.

emulsion of mustard or a solution of pure sinigrin brought into
with myrosin, frequently deposits sulphur by decomposition of
l sulphocyanide, hence crude oil of mustard sometimes contains
derable proportion (even half) of *Allyl cyanide*, C^4H^5N, distin-
l by its lower sp. gr. (0·839) and lower boiling point (118° C.).

seeds, roots, or herbaceous part of many other plants of the order
ræ yield a volatile oil composed in part of mustard oil and in part
sulphide $C^6H^{10}S = \left.\begin{matrix}C^3H^5\\C^3H^5\end{matrix}\right\} S$, which latter is likewise obtainable
e bulbs of garlic. Many *Cruciferæ* afford from their roots or seeds
or solely oil of mustard, and from their leaves oil of garlick. As
r plants, the roots of *Reseda lutea* L. and *R. luteola* L. have
own by Volhard (1871) to afford oil of mustard.[1]

artificial preparation of mustard oil was discovered in 1855 by
and at the same time also by Berthelot and De Luca.

stard submitted to pressure affords about 23 per cent.[2] of a mild-
. inodorous, non-drying oil, solidifying when cooled to −17·5° C.
nsisting of the glycerin compounds of stearic, oleic and *Erucic* or
Acid. The last-named acid, $C^{22}H^{42}O^2$, occurs also in the fixed
white mustard and of rape, and is homologous with oleic acid.
(1849) has pointed out the existence of another body, *Sinapoleic*
$C^{20}H^{38}O^2$, which occurs in the fixed oil of both black and white
d.

tard seed when ripe is devoid of starch; the mucilage which its
mis affords amounts to 19 per cent. of the seed (Hoffmann). The
nstituents amounting to 4 per cent. consist chiefly of the phos-
of calcium, magnesium, and potassium.

tes—Black mustard is employed in the form of poultice as a powerful
al stimulant; but it is rarely used in its pure state as the *Flour of*

[1] See *Radix Armoraciæ*, p. 68.

[2] I have obtained as much as 33·8 per cent. by means of boiling ether.—F. A. F.

Mustard prepared for the table, which contains in addition white mustard, answers perfectly well and is at hand in every house.[1]

The essential oil of mustard dissolved in spirit of wine is occasionally prescribed as a liniment.

Substitute—*Brassica juncea* Hook. f. et Th. (*Sinapis juncea* L.) is extensively cultivated throughout India (where *B. nigra* is rarely grown), Central Africa, and generally in warm countries where it replaces *B. nigra* and is applied to the same uses. Its seeds constitute a portion of the mustard of Europe, as we may infer from the fact that British India exported in the year 1871–72, of "*Mustard seed*," 1418 tons, of which 790 tons were shipped to the United Kingdom, and 516 tons to France.[2] *B. juncea* is largely grown in the south of Russia and in the steppes north-east of the Caspian where it appears to flourish particularly well in the saline soil. At Sarepta in the Government of Saratov, an establishment has existed since the beginning of the present century where this sort of mustard is prepared for use to the extent of 800 tons of seed annually. The seeds make a fine yellow powder employed both for culinary and medicinal purposes. By pressure they yield more than 20 per cent. of fixed oil which is used in Russia like the best olive oil. The seeds closely resemble those of *B. nigra* and afford when distilled the same essential oil.

SEMEN SINAPIS ALBÆ.

White Mustard; F. *Moutarde blanche ou Anglaise;* G. *Weisser Senf.*

Botanical Origin—*Brassica alba* Hook. f. et Th. (*Sinapis alba* L.) This plant appears to belong to the more southern countries of Europe and Western Asia. According to Chinese authors,[3] it was introduced into China from the latter region. Its cultivation in England is of recent introduction, but is rapidly extending.[4] The plant is not uncommon as a weed on cultivated land.

History—White mustard was used in former times indiscriminately with the brown. In the materia medica of the *London Pharmacopœia* of 1720 the two sorts are separately prescribed. The important chemical distinction between them was first made known in 1831 by Boutron-Charlard and Robiquet.[5]

Production—White mustard is grown as an agricultural crop in Essex and Cambridgeshire.

Description—*Brassica alba* differs from *B. nigra* in having the pods bristly and spreading. They are about an inch long, half the length being occupied by a flat veiny beak. Each pod contains 4 to 6 yellowish seeds about $\frac{1}{12}$ of an inch in diameter and $\frac{1}{10}$ of a grain in weight. The brittle, nearly transparent and colourless testa encloses an embryo of a bright pure yellow and of the same structure as that of black mustard.

[1] The best *Flour of Mustard* such as is made by the large manufacturers, contains nothing but brown and white mustard seeds. But the lower and cheaper qualities made by the same firms contain flour, turmeric, and capsicum. Unmixed flour of Black Mustard is however kept for those who care to purchase it.

[2] *Annual Statement of the Trade and Navigation of British India*, Calcutta, 1872. 62.

[3] Bretschneider, *Study of Chinese Botanic Works*, 1870. 17.

[4] Morton's *Cyclop. of Agriculture*, ii. (1855) 440.

[5] *Journ. de Pharm.* xvii. (1831) 279.

The surface of the testa is likewise pitted in a reticulate manner but so finely that it appears smooth except under a high magnifying power.

When triturated with water the seeds form a yellowish emulsion of very pungent taste, but it is inodorous and does not under any circumstances yield a volatile oil. The powdered seeds made into a paste with cold water act as a highly stimulating cataplasm. The entire seeds yield to cold water an abundance of mucilage.

Microscopic Structure—The epidermal cells of white mustard afford a good illustration of a mucilage-yielding layer such as is met with under many variations, in the seeds of numerous plants. The cuticle consists of large vaulted cells, exhibiting very regular hexagonal outlines when cut across.[1] The inner layer of the epidermis is made up of thin-walled cells, which when moistened swell and give off the mucilage. In the dry state or seen under oil, the outlines of the single cells of this layer are not distinguishable. The tissue of the cotyledons is loaded with drops of fatty oil and with granular albuminoid matter; starch which is present in the seed while young, is altogether absent when the latter reaches maturity.

Chemical Composition—White mustard deprived of fatty oil yields to boiling alcohol colourless crystals of *Sinalbin*, an indifferent substance, readily soluble in cold water, but sparingly in cold alcohol. From the able investigations of Will (1870) it follows, that it is to be regarded as composed of three bodies, namely:

Sulphocyanate of Acrinyl	C^8	H^7	N	S	O
Sulphate of Sinapine	C^{16}	H^{25}	N	S	O^9
Sugar	C^6	H^{12}			O^6

so that the formula $C^{30}\ H^{44}\ N^2\ S^2\ O^{16}$ represents according to Will the composition of sinalbin. It is actually resolved into these three substances when placed at ordinary temperatures, in contact with water and *Myrosin*, the latter of which is a constituent of white mustard as well as of brown (p. 63). The liquid becomes turbid, the first of the above-named substances separates (together with coagulated albumin) as an oily liquid, not soluble in water, but dissolving in alcohol or ether. This *Sulphocyanate of Acrinyl* is the rubefacient and vesicating principle of white mustard. It does not pre-exist, as shown by Will, in the seed and cannot be obtained by distillation. By treating it with a salt of silver, Will obtained crystals of cyanide of acrinyl, C^8H^7NO: by warming it (or sinalbin itself, or an alcoholic extract of the seed) with caustic potash, sulphocyanide of potassium is produced. The presence of the latter may be indicated by adding a drop of perchloride of iron, when a blood-red coloration will be produced.[2]

Sulphate of Sinapine imparts to the emulsion of white mustard, in which it is formed, an acid reaction. Sinapine is itself an alkaloid, which has not yet been isolated, as it is very liable to change. Thus its solution on addition of a trace of alkali immediately assumes a bright yellow colour indicating decomposition, and a similar colour is produced in an aqueous extract of the seed.

[1] An interesting object for the polarizing microscope.

[2] The red compound thus formed with sulphocyanide is readily soluble in ether, yet in the case of white mustard we find it not to be so.

The above statements show, that the chemical properties of sinalbin and its derivatives correspond closely with those of sinigrin (p. 62) and the substances which make their appearance in an emulsion of black mustard.

The other constituents of white mustard seed are nearly the same as those of black. The fat oil appears to yield in addition to the acids mentioned at p. 63, *Benic Acid*, $C^{22}H^{44}O^2$. White mustard is said to be richer than black in myrosin, so that, as explained in the previous article, the pungency of the latter may be often increased by an addition of white mustard. By burning white mustard dried at 100° C., with soda-lime, we obtained from 4·20 to 4·30 per cent. of nitrogen, answering to about 28 per cent. of protein substances.[1] The fixed oil of the seed amounts to 22 per cent. The mucilage as yielded by the epidermis is precipitable by alcohol, neutral lead acetate, or ferric chloride, and is soluble in water after drying.

Erucin and *Sinapic Acid* mentioned by Simon (1838)[2] as peculiar constituents of white mustard are altogether doubtful, yet may deserve further investigation. The sinapic acid of Von Babo and Hirschbrunn[3] (1852) is a product of the decomposition of sinapine.

Uses—White Mustard seeds reduced to powder and made into a paste with cold water act as a powerful stimulant when applied to the skin, notwithstanding that such paste is entirely wanting in essential oil. But for sinapisms they are actually used only in the form of the *Flour of Mustard* which is prepared for the table and which contains also Brown Mustard seed.

RADIX ARMORACIÆ.

Horse-radish ; F. *Raifort* (*i.e. racine forte*), *Cran de Bretagne ;* G. *Meerrettig.*

Botanical Origin—*Cochlearia Armoracia* L., a common perennial with a stout tapering root, large coarse oblong leaves with long stalks, and erect flowering racemes 2 to 3 feet high. It is indigenous to the eastern parts of Europe, from the Caspian through Russia and Poland to Finland. In Britain and in other parts of Europe to the polar circle, it occurs cultivated or semi-wild.

History—The vernacular name *Armon* is stated by Pliny[4] to be used in the Pontic regions to designate the *Armoracia* of the Romans, the Wild Radish (*ῥαφανὶς ἀγρία*) of the Greeks, a plant which cannot be positively identified with that under notice.

Horse-radish is called in the Russian language *Chren*, in Lithuanian *Krenai*, in Illyrian *Kren*, a name which has passed into several German dialects, and as *Cran* or *Cranson* into French.

From these and similar facts, De Candolle[5] has drawn the conclusion that the propagation of the plant has travelled from Eastern to Western Europe.

Both the root and leaves of horse-radish were eaten with food in Germany during the middle ages.[6] But the use of the former was not

[1] Experiments performed by Mr. Weppen in my laboratory, 1869.—F. A. F.

[2] Gmelin, *Chemistry*, xiv. (1860) 521 and 529.

[3] Ibid. 521.

[4] Lib. xix. c. 26. (Littré's translation.)

[5] *Géographie Botanique*, ii. (1855) 655.

[6] Meyer, *Geschichte der Botanik*, iii. (1856)

nmon in England until a much later period. The plant though own in England as *Red-cole* in the time of Turner, 1568, is not ntioned by him[1] as used in food, nor is it noticed by Boorde,[2] 1542, his chapter on edible roots. Gerarde[3] at the end of the 16th century narks that horse-radish—"is commonly used among the Germanes sauce to eat fish with, and such like meats, as we do mustard." lf a century later the taste for horse-radish had begun to prevail in gland. Coles[4] (1657) states that the root sliced thin and mixed th vinegar is eaten as a sauce with meat as among the Germans. at the use of horse-radish in France had the same origin is proved by old French name *Moutarde des Allemands.*

The root to which certain medicinal properties had always been signed, was included in the materia medica of the London Pharmapœias of the last century under the name of *Raphanus rusticanus.*

Description—The root which in good ground often attains a length 3 feet and nearly an inch in diameter, is enlarged in its upper part nto a crown, usually dividing into a few short branches each urmounted by a tuft of leaves, and annulated by the scars of fallen oliage; below the crown it tapers slightly, and then for some distance is ften almost cylindrical, throwing off here and there filiform and long lender cylindrical roots, and finally dividing into two or three branches. The root is of a light yellowish brown; internally it is fleshy and erfectly white, and has a short non-fibrous fracture. Before it is roken it is inodorous, but when comminuted it immediately exhales ts characteristic pungent smell. Its well-known pungent taste is not ost in the root carefully dried and not kept too long.

A transverse section of the fresh root displays a large central olumn with a radiate and concentric arrangement of its tissues, which are separated by a small greyish circle from the bark, whose breath is from ½ to 2 lines. In the root-branches there is neither a well-defined liber nor a true pith. The short leaf-bearing branches include a large pith surrounded by a circle of woody bundles. The bark adheres trongly to the central portion, in which zones of annual growth are asily perceptible, at least in older specimens.

Microscopic Structure—The corky layer is made up of small tabular cells as usual in suberous coats. In the succeeding zone of the middle bark, thick-walled yellow cells are scattered through the parenchyme, chiefly at the boundary line of the corky layer. In the root the cellular envelope is not strikingly separated from the liber, whilst in its leafy branches this separation is well marked by wedge-shaped liber bundles, which are accompanied by a group of the yellow longitudinally-elongated stone cells. The woody bundles contain a few short yellow vessels, accompanied by bundles of prosenchymatous, not properly woody cells. The centre, in the root, shows these woody bundles to be separated by the medullary parenchyma; in the branches the central column consists of an uniform pith without woody bundles, the latter forming a circle close to the cambium. The parenchyma

381; Pfeiffer, *Buch der Natur von Konrad von Megenberg*, Stuttgart, 1861. 418.

[1] *Herball*, part 2. (1568) 111.

[2] *Dietary of Helth*, Early English Text Society, 1870. 278.

[3] *Herball*, edited by Johnson, 1636, 240.

[4] *Adam in Eden, or Nature's Paradise*. Lond. 1657. chap. 256.

of the whole root collected in spring is loaded with small starch granules.

Chemical Composition—Among the constituents of horse-radish root (the chemical history of which is however far from perfect) the volatile oil is the most interesting. The fresh root submitted to distillation with water in a glass retort, yields about ½ per mille of oil which is identical with that of Black Mustard as proved in 1843 by Hubatka. He combined it with ammonia and obtained crystals of thiosinammine, the composition of which agreed with the thiosinammine from mustard oil.

An alcoholic extract of the root is devoid of the odour of the oil, but this is quickly evolved on addition of an emulsion of *White* Mustard. The essential oil does not therefore pre-exist, but only sinigrin (myronate of potassium) and an albuminoid matter (myrosin) by whose mutual reaction in the presence of water it is formed (p. 62). This process does not go on in the growing root, perhaps because the two principles in question are not contained in the same cells, or else exist together in some condition that does not allow of their acting on each other,—a state of things analogous to that occurring in the leaves of *Lauro-cerasus*. No crystals of sinigrin are visible in the tissue of horse-radish when examined under the microscope.

By exhausting the root with water either cold or hot, the sinigrin is decomposed and a considerable proportion of bisulphate is found in the concentrated decoction. Alcohol removes from the root some fatty matter and sugar (Winckler 1849). Salts of iron do not alter thin slices of it, tannic matters being absent. The presence of myrosin which at present has been inferred rather than proved, ought to be further investigated.

Uses—An infusion or a distilled spirit of horse-radish is reputed stimulant, diaphoretic, and diuretic, but is not often employed.

Substitute—In India the root of *Moringa pterygosperma* Gärtn. is considered a substitute for horse-radish. It yields by distillation an essential oil of disgusting odour which Broughton who obtained it in minute quantity, has assured us is not identical with that of mustard or of garlick.

CANELLACEÆ.

CORTEX CANELLÆ ALBÆ.

Canella Bark, Canella Alba Bark; F. *Cannelle blanche;* G. *Canella-Rinde.*

Botanical Origin—*Canella alba* Murray, a tree, 20 to 30 or even 50 feet in height, found in the south of Florida, the Bahama Islands (whence alone its bark is exported), Cuba, Jamaica, Ste. Croix, Guadaloupe, Martinique, Barbados and Trinidad.

History—The drug was first mentioned in 1605 by Clusius[1] who remarks that it had been then newly brought to Europe and had received the name of *Canella alba* (White Cinnamon). It was afterwards known as *Costus corticosus, Costus dulcis, Cassia alba, Cassia lignea Jamaicensis* or *Jamaica Winter's Bark.* Dale[2] writing in 1693 notices it as not

[1] *Exotica*, 78. [2] *Pharmacologia*, 432.

infrequently sold for Winter's Bark. Pomet[1] (1694) describes it as synonymous with Winter's Bark, and observes that it is common yet but little employed.

The drug is mentioned by most subsequent writers, some of whom like Pomet probably confounded it with the bark of *Cinnamodendron* (p. 19). It is usually described as produced in Jamaica or Guadaloupe, from which islands no Canella alba is now exported. On the other hand New Providence, one of the Bahamas whence the Canella alba of the present day is shipped, is not named. Nor do we find any allusion to the drug in the records of the Company (1630–50) which was formed for the colonization of New Providence and the other islands of the group, though their staple productions are frequently enumerated.[2]

Canella alba Murr. was described and figured by Sloane (1707) and still better by Patrick Brown in 1789.

Collection—In the Bahamas where the drug is known as *White Wood Bark* or *Cinnamon Bark*, it is collected thus:—preparatory to being stripped from the wood, the bark is gently beaten with a stick which removes the suberous layer. By a further beating, the remaining bark is separated, and having been peeled off and dried, is exported without further preparation.[3]

Description—Canella bark occurs in the form of quills, more or less crooked and irregular, or in channelled pieces from 2 or 3 up to 6, 8, or more inches in length, ½ an inch to 1 or 2 inches in width, and a line or two in thickness. The suberous layer which here and there has escaped removal is silvery grey, and dotted with minute lichens. Commonly the external surface consists of inner cellular layers (*mesophlœum*) of a bright buff, or light orange-brown tint, often a little wrinkled transversely, and dotted (but not always) with round scars. The inner surface is whitish or cinnamon-coloured, either smooth or with slight longitudinal striæ. Some parcels of canella show the bark much bruised and longitudinally fissured by the above-mentioned process of beating. The bark breaks transversely with a short granular fracture which distinctly shows the three, or in uncoated specimens the two, cortical layers, that of the liber being the largest and projecting by undulated rays or bundles into the middle layer, which presents numerous large and unevenly scattered oil-cells of a yellow colour.

Canella has an agreeable cinnamon-like odour and a bitter, pungent acrid taste.[4] Even the corky coat is somewhat aromatic.

Microscopical Structure—The spongy suberous coat consists of very numerous layers of large cells with thin walls showing an undulated rather than rectangular outline. The next small zone is constituted of sclerenchymatous cells in a single, double, or triple row, or forming dense but not very extensive groups. This tissue is sometimes (in unpeeled specimens) a continuous envelope, marking the boundary between the corky layer and the middle portion of the cellular layer; but an in-

[1] *Hist. des Drog.* part i. 130.

[2] *Calendar of State Papers, Colonial Series*, 1574—1660, Lond. 1860.

[3] Information communicated to me by the Hon. J. C. Lees, Chief-Justice of the Bahamas. The second beating would seem to be not always required.—D. H.

[4] A specimen in Sloane's collection in the British Museum labelled "*Cortex Winteranus of the Isles*," but under the microscope seen to be absolutely identical with canella alba, still retains its proper fragrance after nearly centuries.—F. A. F.

terruption in this thick-walled tissue often takes place when portions of it are enveloped and separated by the suberous layer.

The proper cellular envelope shows a narrow tissue with numerous very large cells filled with yellow essential oil. The liber forming the chief portion of the whole bark, exhibits thin prosenchymatous cells, which on transverse section form small bands of a peculiar horny or cartilaginous appearance, on which account they have been distinguished as *horny liber* (*hornbast* of German writers).[1] The liber-fibres show reticulated marks due to the peculiar character of the secondary deposits on their cell walls. The oil-cells in the liber are less numerous and smaller; the medullary rays are not very obvious unless on account of the crystalline tufts of oxalate of calcium deposited in the latter. This crystalline oxalate retains air obstinately and has a striking dark appearance.

Chemical Composition—The most interesting body in canella is the volatile oil examined in 1843 under Wöhler's direction by Meyer and Von Reiche, who obtained it in the proportion of 0·94 from 100 parts of bark. They found it to consist of four different oils, the first being identical with the *Eugenic Acid* of oil of cloves; the second is closely allied to the chief constituent of cajuput oil. The other oils require further examination.[2]

The bark of which we distilled 20lb., afforded 0·74 per cent. of oil. This when distilled with caustic potash in excess was found to be composed of 2 parts of the acid portion and 1 part of the neutral hydrocarbon; the latter has an odour suggesting a mixture of peppermint and cajuput.

Meyer and Von Reiche evaporated the aqueous decoction of canella and removed from the bitter extract by alcohol 8 per cent. of mannite, which they ascertained to be the so-called *Canellin* described in 1822 by Petroz and Robinet.

The bark yielded the German chemists 6 per cent. of ash, chiefly carbonate of calcium. The bitter principle has not yet been isolated. An aqueous infusion is not blackened by a persalt of iron.

Commerce—Canella alba is collected in the Bahama Islands and shipped to Europe from Nassau in New Providence, the chief seat of trade in the group.

Uses—The bark is an aromatic stimulant, now but seldom employed. It is used by the West Indian negroes as a condiment.

BIXINEÆ.

SEMEN GYNOCARDIÆ.

Chaulmugra Seed.

Botanical Origin—*Gynocardia odorata* R. Br. (*Chaulmoogra* Roxb. *Hydnocarpus* Lindl.), a large tree with a globular fruit of the size of a shaddock, containing numerous seeds immersed in pulp. It grows in the forests of the Malayan peninsula and Eastern India as far north as

[1] First figured and described by Oudemans,—*Aanteekeningen op het . . . . Gedeelte der Pharm. Neerlandica*, 1854–56, 469.

[2] Gmelin, *Chemistry*, xiv. (1860) 210.

extending thence along the base of the Himalaya westward to

tory—The inhabitants of the south-eastern countries of Asia have :n acquainted with the seeds of certain trees of the tribe *Pangieæ ixineæ*) as a remedy for maladies of the skin. In China a seed *'a-fung-tsze* is imported from Siam[1] where it is known as *Lukrabo* d in a variety of cutaneous complaints. The tree affording it, ; figured in the *Pun-tsao* (*circa* A.D. 1596), has not been recog- y botanists, but from the structure of the seed it is obviously 'elated to *Gynocardia*.[2]

properties of *G. odorata* were known to Roxburgh who Latinizing an name of the tree, called it (1814) *Chaulmoogra odorata*. Of rs the seeds have attracted the notice of Europeans in India, and been found useful in certain skin diseases, they have been l a place in the *Pharmacopœia of India*.

cription—The seeds, 1 to 1¼ inches long and about half as diameter, are of irregular ovoid form, and more or less angular :ned by mutual pressure; they weigh on an average about 35 ıch. The testa is very thin (about $\frac{1}{50}$ of an inch), brittle, smooth, y; the copious oily albumen encloses a pair of large, plane, leafy, aped cotyledons with a stout radicle.

roscopic Structure—The testa is chiefly formed of cylindrical lled cells. The albumen exhibits large angular cells containing , masses of albuminous matter and tufted crystals of calcium Starch is not present.

nical Composition—No chemical examination of the seeds been made.

s—The seeds are said to have been advantageously used as an e tonic in scrofula, skin diseases and rheumatism. They should from the testa, powdered, and given in the dose of 6 grains y increased. Reduced to a paste and mixed with Simple Oint- ıey constitute the *Unguentum Gynocardiæ* of the *Indian Phar- a*, which, as well as an expressed oil of the seeds, may be d externally in herpes, tinea, &c.

stitute—It has been suggested that the seeds of *Hydnocarpus na* Bl. a tree of Western India, and of *H. venenata* Gärtn., f Ceylon, might be tried where those of *Gynocardia* are not pro- The seeds of both species of *Hydnocarpus* (formerly con- together as *H. inebrians* Vahl) afford a fatty oil which the ıse in cutaneous diseases.[3]

[1] *Commercial Report from H.M. ıeral in Siam for the year* 1871, to Parliament, Aug. 1872, states :uls (640 lb.) of *Lukkrabao Seeds* rted from Bangkok to China in

[2] Hanbury, *Notes on Chinese Mat. Med.* (1862) 23.—Dr. Porter Smith assumes the Chinese drug to be derived from *G. odorata*, but as I have pointed out, the seeds have a much stronger testa than those of that tree. —D. H.

[3] Waring, *Pharm. of India*, 1868. 27.

POLYGALEÆ.

RADIX SENEGÆ.

Radix Senekæ; Senega or Seneka Root; F. *Racine de Polygala de Virginie;* G. *Senegawurzel.*

Botanical Origin—*Polygala Senega* L., a perennial plant with slender ascending stems 6 to 12 inches high, and spikes of dull white flowers resembling in form those of the Common Milkwort of Britain. It is found in British America as far north as the river Saskatchewan, and in the United States from New England to Wisconsin, Kentucky, Tennessee, Virginia and the upper parts of North Carolina.

The plant which frequents rocky open woods and plains, has become somewhat scarce in the Atlantic states, and as a drug it is now chiefly collected in the west.

History—The employment of this root among the Seneca Indians as a remedy for the bite of the rattle-snake attracted the notice of Tennent, a Scotch physician in Virginia; and from the good effects he witnessed he concluded that it might be administered with advantage in pleurisy and peripneumonia. The result of numerous trials made in the years 1734 and 1735 proved the utility of the drug in these complaints, and Tennent communicated his observations to the celebrated Dr. Mead of London in the form of an epistle, afterwards published together with an engraving of the plant then called the *Seneca Rattle-snake Root.*[1] Tennent's practice was to administer the root in powder or as a strong decoction, or more often infused in wine. The new drug was favourably received in Europe, and its virtues discussed in numerous theses and dissertations, one written in 1749 being by Linnæus.[2]

Description—Senega root is developed at its upper end into a knotty crown, in old roots as much as an inch in diameter, from which spring the numerous wiry aerial stems, beset at the base with scaly rudimentary leaves often of a purplish hue. Below the crown is a simple tap-root $\frac{2}{10}$ to $\frac{3}{10}$ of an inch thick, of contorted or somewhat spiral form, which usually soon divides into 2 or 3 spreading branches and smaller filiform rootlets.

The bark is light yellowish-grey, translucent, horny, shrivelled, knotted and partially annulated. Very frequently a keel-shaped ridge occurs, running like a shrunken sinew through the principal root; it has no connexion with the wood, but originates in a one-sided development of the liber-tissue. The bark encloses a pure white, woody column about as thick as itself. After the root has been macerated in water the bark is easily peeled off and the peculiar structure of the wood can then be studied. The latter immediately below the crown is a cylindrical cord, cleft however by numerous, fine, longitudinal fissures. Lower down these fissures increase in an irregular manner, causing a very abnormal development of the wood. Transverse sections of a root therefore differ greatly, the circular woody portion being either penetrated by clefts or wide notches, or one-half or even more is altogether wanting, the space

[1] Tennent (John), *Epistle to Dr. Richard Mead concerning the epidemical diseases of Virginia*, &c., Edinb. 1738.

[2] *Amœnitates Academicæ*, ii. 126.

od should exist being in each case filled up by uniform paren-
.s tissue.

a root has a short brittle fracture, a peculiar rancid odour, and
rid and sourish taste. When handled it disperses an irritating

oscopic Structure—The woody part is built up of dotted
irrounded by short porous ligneous cells; the medullary rays
' one or two rows of the usual small cells. There is no pith in
e of the root. The clefts and notches are filled up with an
issue passing into the primary cortical tissue without a distinct
: large cells of this tissue are spirally striated. In the keel-
idge the proper liber rays may be distinguished from the
/ rays. The former are made up of a soft tissue, hence the
art of the root breaks short together with the wood.

er starch granules nor crystals of oxalate of calcium are present
ot; the chief contents of its tissue are albuminoid granules and
fatty oil.

ıical Composition—The substance to which the drug owes its
taste was distinguished by the name of *Senegin* by Gehlen as
1804, and is probably the same as the *Polygalic Acid* of Que-
136) and of Procter (1859). It appears to be closely allied to
the decomposition-products of the two bodies being the same.
s amorphous, insoluble in ether and in cold water; it forms with
ater a frothing solution possessing feebly acid properties, and
in alkaline liquids with a greenish yellow colour. Like saponin
violent sneezing.

' inorganic acids added to a warm solution of senegin throw
occulent jelly of *Sapogenin*, the liquid retaining in solution un-
able sugar. Alkalis give rise to the same decomposition; but
:ult to split up the senegin completely, and hence the formulas
this process are doubtful. Even the formula of senegin itself
finitely settled. According to Procter, the root yields 5½ per
his substance; according to earlier authorities (who doubtless
s pure) a much larger proportion.

a root contains a little volatile oil, traces of resin, also gum,
malic acid, yellow colouring matter, and sugar (7 per cent.
to Rebling). The *Virginic Acid* said by Quevenne to be con-
it, and the bitter substance *Isolusin* mentioned by Peschier, are
bodies.

—Senega is prescribed as a stimulating expectorant and
useful in pneumonia, asthma and rheumatism. It is much
in America.

teration—The drug is not liable to be wilfully falsified, but
:areless collecting there is occasionally a slight admixture of
ts. One of these is American Ginseng (*Panax quinquefolium*
ndle-shaped root which may be found here and there both in
ıd serpentaria. The rhizome of *Cypripedium pubescens* Willd.
been noticed; it cannot be confounded with that of *Polygala*

RADIX KRAMERIÆ.

Radix Ratanhiæ, Rhatanhiæ v. Rathaniæ; Rhatany or Rhatania Root, Peruvian or Payta Rhatany; F. *Racine de Ratanhia;* G. *Ratanhiawurzel.*[1]

Botanical Origin—*Krameria triandra* Ruiz et Pav., a small woody shrub with an upright stem scarcely a foot high and thick decumbent branches 2 to 3 feet long. It delights in the barren sandy declivities of the Bolivian and Peruvian Cordilleras at 3000 to 8000 feet above the sea-level, often occurring in great abundance and adorning the ground with its red starlike flowers and silver-grey foliage.

The root is gathered chiefly to the north, north-east, and east of Lima, as at Caxatambo, Huanuco, Tarma, Jauja, Huarochiri and Canta; occasionally on the high lands about lake Titicaca. It appears likewise to be collected in the northern part of Peru, since the drug is now frequently shipped from Payta.

History—Hipolito Ruiz[2] the Spanish botanist observed in 1784 that the women of Huanuco and Lima were in the habit of using for the preservation of their teeth a root which he recognized as that of *Krameria triandra*, a plant discovered by himself in 1779. On his return to Europe he obtained admission for this root into Spain in 1796, whence it was gradually introduced into other countries of Europe.

The first supplies which reached England formed part of the cargo of a Spanish prize, and were sold in the London drug sales at the commencement of the present century. Some fell into the hands of Dr. Reece who recommended it to the profession.[3]

About 20 years ago there appeared in the European market some other kinds of rhatany previously unknown: of these the more important are noticed at p. 76.

Description—The root which attains a considerable size in proportion to the aerial part of the shrub, consists of a short thick crown, sometimes much knotted and as large as a man's fist. This ramifies beneath the soil even more than above, throwing out an abundance of branching, woody roots (frequently horizontal) some feet long and $\frac{1}{4}$ to $\frac{1}{2}$ an inch thick. These long roots used formerly to be found in commerce; but of late years rhatany has consisted in large proportion of the more woody central part of the root with short stumpy branches, which from their broken and bruised appearance have evidently been extracted with difficulty from a hard soil.

The bark which is scaly and rugged, and $\frac{1}{10}$ to $\frac{1}{20}$ of an inch in thickness, is of a dark reddish brown. It consists of a loose cracked cork-layer, mostly smooth in the smaller roots, covering a bright brown-red inner bark, which adheres though not very firmly to a brownish yellow wood. The bark is rather tough, breaking with a fibrous fracture. The wood is dense, without pith, but marked with thin vessels arranged in concentric rings, and with still thinner, dark medullary rays. The taste of the bark is purely astringent; the wood is almost tasteless: neither possesses any distinctive odour.

[1] Ruiz and Pavon state that the root is called at Huanuco *ratanhia*. The derivation of the word which is of the Quichua language is obscure.

[2] *Mem. de la R. Acad. méd. de Madrid*, i. (1797) 349—366.

[3] *Medical and Chirurgical Review*, Lond., xiii. (1806) ccxlvi.; also Reece, *Dict. of Domest. Med.*, 1808.

›scopic Structure—The chief portion of the bark is formed which in transverse section exhibits numerous bundles of ›res separated by parenchymatous tissue and traversed by ›own medullary rays. The small layer of the primary bark is of large cells, the surface of the root of large suberous cells ›ith red matter. The latter also occurs in the inner cortical l ought to be removed by means of ammonia in order to get a ı of the structure. Many of the parenchymatous cells are ith starch granules; oxalate of calcium occurs in the neigh- of the liber bundles. The woody portion exhibits no structure ılar interest.

ıical Composition—Wittstein (1854) found in the bark of the only part of the drug having active properties) about ɜnt. of a form of tannin called *Ratanhia-tannic Acid*, closely catechu-tannic acid. It is an amorphous powder, the solution is not affected by emetic tartar, but yields with ferric chloride, ɜenish precipitate. By distillation Eissfeldt (1854) obtained hin as a product of the decomposition of ratanhia-tannic acid. r is also decomposed by dilute acids which convert it into ıble sugar and *Ratanhia-red* a substance nearly insoluble in o occurring in abundance ready formed in the bark.

wski (1867) showed that by fusing ratanhia-red with caustic oto-catechuic acid and phloroglucin [1] are obtained. Ratanhia- ıe composition $C^{26}H^{22}O^{11}$, the same according to Grabowski, as ;ous product of the decomposition of the peculiar tannic acid (as shown by Rochleder in 1866) in the horse-chesnut. red substance may also be obtained, as stated by Rembold rom the tannic acid of the root of tormentil (*Potentilla la* L.).

rhatany root, Wittstein also found it to contain wax, gum and lizable sugar (even in the wood! according to Cotton [2]). Cotton ointed out the presence in very minute quantity of an odorous, olid body, obtainable by means of ether or bisulphide of carbon; in a somewhat more considerable amount in the other sorts of The root contains no gallic acid.

y extract of rhatany resembling kino used formerly to be from South America, but how and where manufactured we t. It is however of some interest as containing a crystalline ich Wittstein who discovered it (1854) regards as *Tyrosin*, ', previously supposed to be exclusively of animal origin.[3] Its rith tyrosin has been called in question by Städeler and Ruge ho assign to it a slightly different composition, $C^{10}H^{13}NO^3$, and e name of *Ratanhin*. The same substance has been abundantly ı by Gintl (1868) in the natural exudation called *Resina ı pedra* which flows from the alburnum of *Ferreirea spectabilis* large Brazilian tree of the order *Leguminosæ* (tribe *Sophoreæ*). who first extracted it, named it *Angelin*; it forms colourless, ystals yielding compounds both with alkalis and acids, which ı investigated by Gintl in 1869 and 1870.

Kino.

[3] Gmelin, *Chemistry*, xiii. (1859) 358.

ur le Genre Krameria (thèse).

53.

Uses—Rhatany is a valuable astringent, but is not much employed in Great Britain.

Other sorts of Rhatany—Of the 20 to 25 other species of *Krameria*, all of them belonging to America, several have astringent roots which have been collected and used in the place of the rhatany of Peru. The most important of these drugs is that known as—

Savanilla or *New Granada Rhatany.* The plant yielding it is *Krameria tomentosa* St. Hil. (*Kr. Ixina* var. *β granatensis* Triana, *Kr. grandifolia* Berg), a shrub 4 to 6 feet high covering large arid tracts in the valley of Jiron between Pamplona and the Magdalena in New Granada, in which locality the collection of the root was observed by Weir in 1864.[1] According to Triana it also grows at Socorro, south of Jiron. The same plant is found near Santa Marta and Rio Hacha in north-eastern New Granada, in British Guiana, and in the Brazilian provinces of Pernambuco and Goyaz.

The stem or root-crown of Savanilla rhatany is never so knotty and irregular as that of the Peruvian drug, nor are the roots so long or so thick. Separate pieces of root of sinuous form, 4 to 6 inches long and $\frac{2}{10}$ to $\frac{3}{10}$ of an inch thick are most frequent. The drug is moreover well distinguished by its dull purplish brown colour, its thick smooth bark marked with longitudinal furrows, and here and there with deep transverse cracks, and by the bark not easily splitting off as it does in common rhatany.

The anatomical difference depends chiefly upon the more abundant development of the bark which in thickness is $\frac{1}{3}$ to $\frac{1}{4}$ the diameter of the wood. In Peruvian rhatany the cortical layer attains only $\frac{1}{6}$ to $\frac{1}{8}$ of the diameter of the woody column. The greater firmness of the suberous coat in Savanilla rhatany is due to its cells being densely filled with colouring matter.

Savanilla rhatany differs from the Peruvian root in its tannic matter. This becomes evident by shaking the powdered root (or bark) with water and iron reduced by hydrogen. The liquid filtered from the Savanilla sort and diluted with distilled water exhibits an intense violet colour, that from Peruvian rhatany a dingy brown; the latter turns light red by alkalis. Thin sections of the Peruvian root assume a greyish hue when moistened with a ferrous salt; Savanilla root by a similar treatment displays the above violet colour. The Savanilla root is richer in soluble matter and from the greater development of its bark may deserve to be preferred for medicinal use.

Pará Rhatany,—so called from having been shipped from Pará in Brazil. Berg who described it in 1865 termed it *Brazilian Rhatany*, Cotton in 1868, *Ratanhia des Antilles.* It is a drug nearly resembling the preceding, but of a darker and less purple hue; it is also in longer sticks which are remarkably flexible, and covered with a thick bark having numerous transverse cracks.[2] It is apparently derived from the *Krameria argentea* of Martius,[3] the root of which is collected in the dry districts of the provinces of Bahia and Minas Geraes.

[1] Hanbury, *Origin of Savanilla Rhatany*, in *Pharm. Journ.* vi. (1865) 460.—In this paper I referred the drug to a variety of *Kr. Ixina* which M. Cotton has shown to differ in no respect from St. Hilaire's *Kr. tomentosa*, a conclusion in which, after careful reexamination of specimens, I fully agree.—D. H.

[2] For further particulars, see Flückiger, *Pharm. Journ.*, July 30, 1870. 84.

[3] *Syst. Mat. Med. Bras.*, 1843. 51; Langgaard, *Diccionario de Medicina*, Rio de Janeiro, iii. (1865) 384.

of rhatany attributed to *Krameria secundiflora* DC., a plant Texas and Arkansas, was furnished to Berg in 1854 by a gist, but has not been in general commerce. Its anatomical as been described by Berg.[1]

oidea Hook, a plant scarcely to be distinguished from *Kr.* ffords in Chili a rhatany very much like that of Peru. Its ntributed to the Paris Exhibition of 1867.

GUTTIFERÆ.

CAMBOGIA.

mbogia, Gummi Gutti; Gamboge; F. *Gomme Gutte;* G. *Gutti, Gummigutt.*

ical Origin—*Garcinia Morella* Desrousseaux, var. *β. pedicellata,* s tree with handsome laurel-like foliage and small yellow ınd in Camboja, Siam (province of Chantibun and the islands ıt coast of the gulf of Siam), and in the southern parts of ina. It was introduced about thirty years ago into Singapore ral specimens are still thriving (1873) on the estate of Dr. he finest is now a tree of 20 feet high, with a trunk a foot in and a thick, spreading head of foliage.

ry—The Chinese had intercourse with Camboja as early as the Sung Dynasty (A.D. 970—1127); and a Chinese traveller who e latter country in 1295–97, describes gamboge and the f obtaining it by incisions in the stem of the tree.[2] The cele- inese herbal *Pun-tsao,* written towards the close of the 16th mentions gamboge (*Tang-hwang*) and gives a rude figure of The drug is regarded by the Chinese as poisonous, and is mployed except as a pigment.

rst notice of the occurrence of gamboge in Europe is in the f Clusius[3] who describes a specimen brought from China by h Admiral Van Neck and given to him in 1603, under the *Ghittaiemou.*[4] It appears that shortly after this time it began ployed in medicine in Europe, for in a tariff of prices of the ies of Schweinfurt printed in 1614,[5] it is thus named:—"*succus ou, Indian. Purgiersaft, ein quintlein,* 16 *schilling.*" In the r there was published at Leipzig a pamphlet by Michael Reuden *De novo gummi purgante epistola,* treating of gamboge.[6]

15, a considerable quantity of gamboge was offered for sale in by the East India Company. The entry respecting it in the nute Books of the Company under date October 13, 1615, is to t:—Three chests, one rundlet, and a basket, containing 13, 5 hundredweights, more or less, of *Cambogium* "*a drugge un-*

itung, 14th Nov. 1856. 797.

tion de Camboge in Abel-Remusat's *nges Asiatiques,* i. (1829) 134.—se traveller calls the exudation ng which is the name for *tur-* his description is unmistakeable. (1605) 82.

Rost is of opinion that this word from the Malay *gătăh,* gum, and the Javanese *jamú* signifying *medicinal,* such mixing of the two languages being of common occurrence.

[5] *Valor sive Taxatio omnium materierum medicarum . . . quæ in officinâ pharmaceuticâ Swinphordianâ venundantur,* Giessen, 1614. 38. (Brit. Mus.)

[6] We have only seen the second edition publi d den in 1625.

known here,"—the use of which was much commended as "*a gentle purge*," were offered for sale at 5*s*. per lb., but met with no purchaser.

Parkinson[1] who was an apothecary of London and wrote in 1640 speaks of "this *Cambugio*," called by some *Catharticum aureum*, as a drug of recent importation which arrived in the form of "*wreathes or roules*" yellow within and without.

In the *London Pharmacopœia* of 1650, gamboge is called *Gutta Gamba*[2] or *Ghitta jemou*.

The place of production of the drug was first made known in 1658 by Bontius,[3] a Dutch physician resident in Java; but the tree was not fully examined and figured until 1864.[4]

Secretion—We have examined a portion of a branch two inches in diameter of the gamboge-tree,[5] and have found the yellow gum-resin to be contained chiefly in the middle layer of the bark in numerous ducts like those occurring in the roots of *Inula Helenium*. A little is also secreted in the dotted vessels of the outermost layer of the wood, and in the pith. The wood which is white, acquires a bright yellow tint when exposed to the vapour of ammonia or to alkaline solutions.

Production—At the commencement of the rainy season the gamboge-collectors start for the forest in search of the trees which in some localities are plentiful. Having found one of full size they make a spiral incision in the bark round half the circumference of the trunk, and place a joint of bamboo to receive the sap which slowly exudes for several months. When it first issues from the tree, it is a yellowish fluid, which after passing through a viscid state hardens into the gamboge of commerce.

The trees grow both in the valleys and on the mountains and will yield on an average in one season enough to fill three joints of bamboo 20 inches in length by 1½ inches in diameter. The tree appears to suffer no injury provided the tapping is not more frequent than every other year.[6]

Description—The drug arrives in the form of sticks or cylinders 1 to 2½ inches in diameter, and 4 to 8 inches in length, striated lengthwise with impressions from the inside of the bamboo. Often the sticks are agglutinated, or folded, or the drug is in compressed or in shapeless masses. It is when good of a rich brownish orange tint, dense and homogeneous, breaking easily with a conchoidal fracture, scarcely translucent even in thin splinters. Touched with water it instantly forms a yellow emulsion. Triturated in a mortar it affords a brilliant yellow powder, slightly odorous. Gamboge has a disagreeable acrid taste.

Much of the gamboge shipped to Europe is of inferior quality being of a brownish hue or exhibiting when broken a rough, granular, bubbly surface. Sometimes it arrives imperfectly dried and still soft.

[1] *Theatrum Botanicum* (1640) 1575.

[2] This name is the Hindustani *Gótá-ganbá*, signifying according to Moodeen Sheriff (*Suppl. to Pharm. of India*, 83) *juice or extract of rhubarb*. It is still applied to gamboge.

[3] *Hist. nat. et méd. Ind. Orient.* 153, forming part of Piso's work *De Indiæ re nat. et med.* 1658.

[4] Hanbury in *Trans. of Linn. Soc.* xxiv. (1864) 487. tab. 50.

[5] Obligingly sent to us by Dr. Jamie of Singapore.

[6] Spenser St. John, *Life in the Forests of the Far East*, Lond. 1862. ii. 272.

Chemical Composition—Gamboge consists of a mixture of resin h 15 to 20 per cent. of gum. The resin dissolves easily in alcohol ning a clear liquid of fine yellowish-red hue, and neutral or very ;htly acid reaction. It forms darker-coloured solutions with ammonia he fixed alkalis, and a copious precipitate with basic acetate of lead. chloride of iron colours a solution of the resin deep blackish brown. By fusing purified gamboge resin with potash, Hlasiwetz and Barth 66) obtained together with fatty acids and other acids of peculiar ure, about one per cent. of *Phloroglucin* (see art. *Kino*).

The gum which we obtained to the extent of 15·8 per cent. by npletely exhausting gamboge with alcohol and ether, was found readily uble in water. The solution does not redden litmus and is not cipitated by neutral acetate of lead, nor by perchloride of iron, nor silicate or biborate of sodium. It is therefore not identical with n arabic.

Commerce—The drug finds its way to Europe from Camboja mostly Singapore or Bangkok; it has of late been shipped also from igon. The exports from Bangkok in 1871 were 358 peculs (47,733lb.) lue 17,759 dollars.[1]

Uses—Gamboge is a drastic purgative, seldom administered except combination with other substances.

Adulteration—The Cambojans adulterate gamboge with rice flour, d, or the pulverized bark of the tree,[2] which substances may be easily tected in the residue left after exhausting the drug successively by rit of wine and cold water.

Other Sources of Gamboge—Although the gamboge of European mmerce appears to be exclusively derived from the plant named at head of this article, the following species of *Garcinia* are capable of lding a similar drug which is collected to some small extent for local , but not for exportation.

1. *G. Morella* Desr.—The typical form of this tree having *sessile* male wers grows in moist forests of Southern India and Ceylon, and is uable of affording good gamboge.

2. *G. pictoria* Roxb., a large tree of Southern India produces a sort of uboge found by Christison (1846) essentially the same as that of m. It has been examined more recently by Broughton (1871) who tes it to be quite equal to that of *G. Morella*.

3. *G. Travancorica* Beddome, a beautiful tree of the southern forests Travancore and the Tinnevelly Ghats (3000 to 4500 feet). According its discoverer Lieut. Beddome,[3] it yields an abundance of bright low gamboge.

OLEUM GARCINIÆ.

Concrete Oil of Mangosteen, Kokum Butter.

Botanical Origin—*Garcinia indica* Choisy (G. *purpurea* Roxb. *adonia indica* Dup. Th.), an elegant tree with drooping branches and k green leaves. It bears a smooth round fruit the size of a small

[1] *Report from H.M. Consul-General in* , *for* 1871.
[2] Spencer St. John, *op. cit.*
[3] *Flora Sylvatica*, Madras, part xv. (1872) tab. 173.

apple, containing an acid purple pulp in which are lodged as many as 8 seeds. The tree is a native of the coast region of Western India known as the Concan lying between Daman and Goa.

History—The fruit is mentioned by Garcia d'Orta (1563) as known to the Portuguese of Goa by the name of *Brindones*. He states that it has a pleasant taste though very sour, and that it is used in dyeing; and further that the peel serves to make a sort of vinegar. Several succeeding authors (as Bauhin and Ray) have contented themselves with repeating this account.

As to the fruit yielding a fatty oil, we find no reference to such fact till about the year 1830, when it was stated in an Indian newspaper[1] that an oil of the seeds is well known at Goa and often used to adulterate ghee (liquid butter). It was afterwards pointed out as the result of some experiments that the oil was of an agreeable bland taste and well adapted for use in pharmacy. A short article on Kokum Butter was published by Pereira[2] in 1851. With the view of bringing the substance into use for pharmaceutical preparations in India, it has been introduced into the *Pharmacopœia of India* of 1868.

Preparation—The seeds are reniform, somewhat crescent-shaped or oblong, laterally compressed and wrinkled, $\frac{6}{10}$ to $\frac{8}{10}$ of an inch long by about $\frac{4}{10}$ broad. Each seed weighs on an average about eight grains. The thick cotyledons, which are inseparable, have a mild oily taste. Examination under the microscope shows them to be built up of large reticulated cells containing a considerable proportion of crystalline fat readily soluble in benzol. In addition globular masses of albuminous matter occur which with iodine assume a brownish yellow hue. With perchloride of iron the walls strike a greenish-black.

The process followed by the natives of India (by whom alone the oil is prepared) has been thus described:—The seeds having been dried by exposure for some days to the sun are bruised, and boiled in water. The oil collects on the surface, and concretes when cool into a cake which requires to be purified by melting and straining.

Description—Kokum Butter is found in the Indian bazaars in the form of egg-shaped or oblong lumps about 4 inches long by 2 inches in diameter, and weighing about a quarter of a pound. It is a whitish substance, at ordinary temperatures, firm, dry, and friable, yet greasy to the touch. Scrapings (which are even pulverulent) when examined in glycerin under the microscope show it to be thoroughly crystalline. They have a mild oily taste, yet redden litmus if moistened with alcohol.

By filtration in a steam-bath, kokum butter is obtained perfectly transparent and of a light straw-colour, concreting again at 27·5° C. into a white crystalline mass: some crystals appear even at 30°. Melted in a narrow tube, cooled and then warmed in a water bath, the fat begins to melt at 42·5° C., and fuses entirely at 45°. The residue left after filtration of the crude fat is inconsiderable and consists chiefly of brown tannic matters soluble in spirit of wine.

When kokum butter is long kept it acquires an unpleasant rancid smell and brownish hue, and an efflorescence of shining tufted crystals appears on the surface of the mass.

[1] Quoted by Graham, *Catal. of Bombay Plants*, 1839. 25.

[2] *Pharm. Journ.* xi. (1852) 65.

mical Composition — Purified kokum butter boiled with ıoda yields a fine hard soap which when decomposed with sul- cid affords a crystalline cake of fatty acids weighing as much as nal fat. The acids were again combined with soda and the soap ıeen decomposed, they were dissolved in alcohol of about 94 per y slow cooling and evaporation crystals were first formed which ırfectly dried, melted at 69·5° C. : they are consequently *Stearic* ı less considerable amount of crystals which separated subse- had a fusing point of 55° C. and may be referred to *Myristic*

ırtion of the crude fat was heated with oxide of lead and water, plumbic compound dried and exhausted with ether, which ıporation left a very small amount of liquid oil, which we refer *Acid.*

lly the sulphuric acid used at the outset of the experiments was l and examined in the usual manner for volatile fatty acids valerianic, &c.) but with negative results.

fat of the seeds of *G. indica* was extracted by ether and examined lly in 1857 by J. Bouis and d'Oliveira Pimentel.[1] It was to the extent of 30 per cent., was found to fuse at 40° C. ɔnsist chiefly of stearin (tristearin). The seeds yielded 1·72 per nitrogen. Their residue after exhaustion by ether afforded to solutions or alcohol a fine red colour.

s—The results of the experiments above-noted show that kokum ; well suited for some pharmaceutical preparations. It might advantageously employed in candle-making, as it yields stearic ·e easily and in a purer state than tallow and most other fats. t it is possible to obtain it in quantities sufficiently large for ıt industrial uses, appears to us very problematical.

DIPTEROCARPEÆ.

BALSAMUM DIPTEROCARPI.

Balsamum Gurjunæ ; Gurjun Balsam, Wood Oil.[2]

ınical Origin—This drug is yielded by several trees of the *ipterocarpus*, namely—

rhinatus Gärtn. f. (*D. lævis* Ham., *D. indicus* Bedd.), a native of Bengal, Chittagong and Pegu to Singapore.

ıcanus Roxb., a tree of Chittagong and Pegu.

ılatus Roxb. growing in Chittagong, Burma, Tenasserim, the n Islands and Siam.

ylanicus Thw. and *D. hispidus* Thw., indigenous to Ceylon.

inerris Bl., a native of Java and the Philippines, and *D. gracilis* Bl.,

[1] *ıs Reudus*, xliv. (1857) 1355.

[2] quid under notice must not be l with the so-called *Wood Oil* of ch is of a totally different nature. is a fatty oil expressed from the *lcurites cordata* Mull. Arg. (*Dry- ata* Thunb.), a tree of the order *Eu-* , found in China and Japan, and is an article of enormous consumption among the Chinese, who use it in the caulking and painting of junks and boats, for preserving woodwork, varnishing furniture, and also in medicine. More than 35 million pounds valued at £547,000 were exported from Hankow alone during the year 1871.

D. littoralis Bl., *D. retusus* Bl. (*D. Spanoghei* Bl.), trees of Java, supply a similar product which appears to be of less commercial importance.

The Gurjun tree is said by Hooker[1] to be one of the most magnificent of the forests of Chittagong. It is conspicuous for its gigantic size. and for the straightness and graceful form of its tall unbranched trunk, and small symmetrical crown of broad glossy leaves. Many individuals are upwards of 200 feet high and 15 feet in girth.

History—Gurjun balsam was enumerated as one of the productions of Ava by Francklin[2] in 1811, and in 1813 it was briefly noticed by Ainslie.[3] Its botanical origin was first made known by Roxburgh who also described the method by which it is extracted.

The medicinal properties of Gurjun balsam were pointed out by O'Shaughnessy[4] as entirely analogous to those of copaiba; and his observations were confirmed by many practitioners in India. This has obtained for the drug a place in the *Pharmacopœia of India* (1868).

Extraction—A recent account of the production of this drug is found in the *Reports of the Jury of the Madras Exhibition of 1855.* It is there stated that *Wood Oil*, as the balsam is commonly called, is obtained for the most part from the coast of Burma and the Straits, and is procured by tapping the trees about the end of the dry season. Several deep incisions are made with an axe into the trunk of the tree and a good-sized cavity scooped out. In this, fire is placed, and kept burning until the wood is somewhat scorched, when the balsam begins to exude and is then led away into a vessel of bamboo. It is afterwards allowed to settle when a clear liquid separates from a thick portion called the "*guad.*" The oil is extracted year after year, and sometimes there are two or three holes in the same tree. It is produced in extraordinary abundance; from 30 to 40 gallons according to Roxburgh may sometimes be obtained from a single tree in the course of a season, during which it is necessary to remove from time to time the old charred surface of the wood and burn afresh.

If a growing tree is felled and cut into pieces, the oleo-resin exudes and concretes on the wood, very much, it is said, *resembling camphor* (!) and having an aromatic smell.

Description—As Gurjun balsam is the produce of different trees as well as of different countries, it is not surprising to find that it varies considerably in its properties.

The following observations refer to a balsam of which 400lb. were recently imported from Moulmein for a London drug firm. It is a thick and viscid fluid, exhibiting a remarkable fluorescence, so that when seen by reflected light it appears opaque and of a dingy greenish grey; yet when placed between the observer and strong daylight it is seen to be perfectly transparent and of a dark reddish-brown. It has a weak aromatic copaiba-like odour and a bitterish aromatic taste without the persistent acridity of copaiba. Its sp. gr. at 16·9° C. is 0·964.

[1] *Himalayan Journals*, ed. 2., ii. (1855) 332.

[2] *Tracts on the Dominions of Ava*, Lond. 1811. 26.

[3] *Mat. Med. of Hindoostan*, Madras, 1813. 186.

[4] *Bengal Dispensatory*, 1842. 222.

With the following liquids Gurjun affords perfectly clear solutions ıich are more or less fluorescent, namely pure benzol (from benzoate of lcium), cumol, chloroform, sulphide of carbon, essential oils. On the ıer hand, it is not entirely soluble in methylic, ethylic, or amylic :ohol, in ether, acetic ether, glacial acetic acid, acetone, phenol ırbolic acid), or in caustic potash dissolved in absolute alcohol. any samples of commercial benzol also are not capable of dis- lving the oleo-resin perfectly, but we have not ascertained on ıat constituent of such benzol this depends. We have noticed wever that that portion of petroleum which is known as *Petroleum ıher*, containing the most volatile hydrocarbons, does not wholly ssolve the oleo-resin, while the less volatile cumol (C^9H^{12}) does so. ne hundred parts of the balsam warmed and shaken with 1000 parts absolute alcohol yielded on cooling a precipitate of resin amounting hen dried to 18·5 parts. All concentrated solutions of the balsam are recipitated by amylic alcohol.

If the balsam is kept for a long time in a stoppered vessel at 100° C. simply becomes a little turbid; but at about 130° C. it is transformed nto a jelly, and on cooling does not resume its former fluidity. Balsam of copaiba heated in a closed glass tube to 220° C. does ıot at all lose its fluidity, whereas Gurjun balsam becomes an almost olid mass.

Chemical Composition—Of the balsam 6·99 grammes dissolved n benzol and kept in a water bath until the residue ceased to lose reight, yielded 3·80 grammes of a dry, transparent, semi-fluid resin, orresponding to 54·44 per cent., and 45·56 of volatile matters expelled y evaporation.

By submitting larger quantities of the balsam to the usual process of listillation with water in a large copper still, 37 per cent. of volatile oil rere easily obtained. The water passing over at the same time did not edden litmus paper. A dark, viscid, liquid resin remained in the still.

The essential oil is of a pale straw-colour and less odorous than most ther volatile oils. Treated with chloride of calcium and again listilled, it begins to boil at 210° C. and passes over at 260° C., equiring a somewhat empyreumatic smell and light yellowish tint. The purified oil has a sp. gr. of 0·915;[1] it is but sparingly soluble in bsolute alcohol or glacial acetic acid, but mixes readily with amylic lcohol.

According to Werner (1862) this oil has the composition $C^{40}H^{32}$, like hat of copaiba. He says it deviates the ray of polarized light to the eft, but that prepared by one of us deviated strongly to the *right*, he residual resin dissolved in benzol being wholly inactive. The oil oes not form a crystalline compound with dry hydrochloric acid, which olours it of a beautiful blue.[2] De Vry[3] states that the essential oil fter this treatment deviates the ray to the right.

The resin contains, like that of copaiba, a small proportion of a rystallizable acid which may be removed by warming it with ammonia in eak alcohol. That part of the resin which is insoluble even in absolute

[1] 0·944 according to Werner; 0·931 Shaughnessy; 0·928 De Vry (1857).

[2] This magnificent colouring matter is no dissolved by ether.

[3] *Pharm. Journ.* xvi. (1857) 374.

alcohol,[1] we found to be uncrystallizable. The *Gurgunic Acid* as the crystallized resinous acid is called by Werner,[2] but which it is more correct to write *Gurjunic*, may consequently be prepared by extracting the resin with alcohol (·838) and mixing the solution with ammonia. From the ammoniacal solution gurjunic acid is precipitated on addition of a mineral acid, and if it is again dissolved in ether and alcohol it may be procured in the form of small crystalline crusts. From the specimen under examination we were not successful in obtaining indubitable crystals.

Gurjunic acid, $C^{44}H^{68}O^{8}$ according to Werner, melts at 220° C., and concretes again at 180° C.; it begins to boil at 260° C., yet at the same time decomposition takes place. By assigning to this acid the formula $C^{44}H^{64}O^{5} + 3H^{2}O$, which agrees well with Werner's analytical results, we may regard it as a hydrate of abietinic acid, the chemical behaviour of which is perfectly analogous. Gurjunic acid is soluble in alcohol 0·838, but not in weak alcohol; it is dissolved also by ether, benzol, or sulphide of carbon (Werner).

In copaiba from Maracaibo, Strauss (1865) discovered *Metacopaivic Acid* which is probably identical with gurjunic; the former however fuses at 206° C.

The amorphous resin forming the chief bulk of the residue of the distillation of the balsam, has not yet been submitted to exact analysis. We find that after complete desiccation it is not soluble in absolute alcohol.

Commerce—Gurjun balsam is exported from Singapore, Moulmein, Akyab and the Malayan Peninsula, and is a common article of trade in Siam. It is likewise produced in Canara in Southern India. It is occasionally shipped to Europe. More than 2000℔ were offered for sale in London under the name of *East Indian Balsam Capivi*, 4th October, 1855; and in October 1858 a no less quantity than 45 casks appeared in the catalogue of a London drug-broker. It is now not unfrequent in the London drug sales.

Uses—In medicine it has hitherto been employed only as a substitute for copaiba, and chiefly in the hospitals of India.

In the East its great use is as a natural varnish, either alone or combined with pigments; and also as a substitute for tar as an application to the seams of boats, and for preserving timber from the attacks of the white ant.

MALVACEÆ.

RADIX ALTHÆÆ.

Marshmallow Root; F. *Racine de Guimauve*; G. *Eibischwurzel*.

Botanical Origin—*Althæa officinalis* L., the marshmallow, grows in moist places throughout Europe, Asia Minor, and the temperate parts of Western and Northern Asia, but is by no means universally distributed. It prefers saline localities such as in Spain the salt marshes of Saragossa, the low-lying southern coasts of France near Montpellier, Southern Russia, and the neighbourhood of salt-springs in Central Europe.

[1] The sample of gurjun balsam examined by Werner as well as the resin it contained were entirely soluble in boiling potash lye.

[2] Gmelin, *Chemistry*, xvii. 545.

In Britain it occurs in the low grounds bordering the Thames below ıdon, and here and there in many other spots in the south of England l of Ireland.

The cultivated marshmallow thrives as far north as Throndhjem in rway, and has been naturalized in North America (salt marshes of w England and New York) and Australia. It is largely cultivated in ·aria and Würtemberg.

History—Marshmallow had many uses in ancient medicine, and is cribed by Dioscorides as Ἀλθαία, a name derived from the Greek verb θαίνειν, *to heal.*

The diffusion of the plant in Europe during the middle ages was pro-ed by Charlemagne who enjoined[1] its culture (A.D. 812) under the ne of "*Mismalvas*, id est alteas quod dicitur ibischa."

Description—The plant has a perennial root attaining about a foot ength and an inch in diameter. For medicinal use the biennial roots the cultivated plant are chiefly employed. When fresh they are ernally yellowish and wrinkled, white within and of tender fleshy ture. Previous to drying the thin outer and a portion of the middle k are scraped off, and the small root filaments are removed. The drug ıs prepared and dried consists of simple whitish sticks 6 to 8 inches ıg, of the thickness of the little finger to that of a quill, deeply furrowed ıgitudinally and marked with brownish scars. Its central portion ich is pure white breaks with a short fracture, but the bark is tough d fibrous. The dried root is rather flexible and easily cut. Its trans-rse section shows the central woody column of undulating outline parated from the thick bark by a fine dark line shaded off outwards.

The root has a peculiar though very faint odour and is of rather ıwkish and insipid taste, and very slimy when chewed.

Microscopic Structure—The greater part of the bark consists of er, abounding in long soft fibres, to which the toughness of the cortical sue is due. They are branched and form bundles each containing m 3 to 30 fibres separated by parenchymatous tissue. Of the cortical renchyme many cells are loaded with starch granules, others contain llate groups of oxalate of calcium, and a considerable number of some-at larger cells are filled with mucilage. The last-named on addition alcohol is seen to consist of different layers.

The woody part is made up of pitted or scalariform vessels, accom-nied by a few ligneous cells and separated by a parenchymatous tissue, reeing with that of the bark. On addition of an alkali, sections of the t assume a bright yellow hue.

Chemical Composition—The mucilage in the dry root amounts to ut 25 per cent. and the starch to as much more. The former appears m the not very accordant analyses of Schmidt and of Mulder to agree th the formula $C^{12}H^{20}O^{10}$, thus differing from the mucilage of gum bic by one molecule less of water. It likewise differs in being pre-itable by neutral acetate of lead. At the same time it does not show behaviour of cellulose, as it does not turn blue by iodine when mois-ed with sulphuric acid, and it is not soluble in ammoniacal solution oxide of copper.

[1] Pertz, *Monumenta Germaniæ historica*, Legum tom. i. (1835) 181.—*Ibischa* from the k ἰβίσκος.

The root also contains pectin and sugar (cane-sugar according to Wittstock), and a trace of fatty oil. Tannin is found in very small quantity in the outer bark alone.

In 1826 Bacon, a pharmacien of Caen, obtained from althæa root crystals of a substance at first regarded as peculiar, but subsequently identified with *Asparagin*, $C^4H^8N^2O^3$, H^2O. It had been previously prepared (1805) by Vauquelin and Robiquet from asparagus and is now known to be a widely-diffused constituent of plants.[1] Marshmallow root does not yield more than 0·8 to 2·0 per cent. Asparagin crystallizes in large prisms or octohedra of the rhombic system; it is nearly tasteless and appears destitute of physiological action. It is quite permanent whether in the solid state or dissolved, but is easily decomposed if the solution contains the albuminoid constituents of the root, which act as a ferment. Leguminous seeds, yeast or decayed cheese induce the same change, the final product of which is succinate of ammonium, the asparagin taking the elements of water and hydrogen set free by the fermentation, thus—

$$\underset{\text{Asparagin}}{C^4H^8N^2O^3} + H^2O + 2H = \underset{\text{Succinate of Ammonium}}{2NH^4, C^4H^4O^4}$$

Under the influence of acids or bases, or even by the prolonged boiling of its aqueous solution, asparagin is converted into *Aspartate of Ammonium*, $C^4H^6(NH^4)NO^4$, of which it contains the elements.

These transformations, especially the former, are undergone by the asparagin in the root, if the latter has been imperfectly dried, or has been kept long, or not very dry. Under such conditions, the asparagin gradually disappears, and the root then yields a yellow decoction, sometimes having a disagreeable odour of butyric acid. There is no doubt that a protein-substance here acts as a ferment.

The peeled root dried at 100° C. and incinerated afforded us 4·88 of ash, rich in phosphates.

Uses—Althæa is taken as a demulcent; it is sometimes also applied as an emollient poultice. It is far more largely used on the continent than in England.

FRUCTUS HIBISCI ESCULENTI.

Capsulæ Hibisci esculenti; Okro, Okra, Bendi-kai[2]; F. *Gombo* (in the French Colonies).

Botanical Origin—*Hibiscus esculentus* L. (*Abelmoschus esculentus Guill. et Perr.*) an herbaceous annual plant 2 to 3 feet high, indigenous to the Old World (Africa?), but now cultivated in all tropical countries.

History—The Spanish Moors appear to have been well acquainted with *Hibiscus esculentus* which was known to them by the same name that it has in Persian at the present day—*Bámiyah*. Abul-Abbas el-Nebáti, a native of Seville learned in plants, who visited Egypt in

[1] It plays an interesting part in the germination of the seeds of papilionaceous plants. It is abundant in the young plants, but in most it speedily disappears. Its presence can be proved in the juice by means of the microscope and absolute alcohol, in which latter asparagin is insoluble. See Pfeffer in Pringsheim's *Jahrb. f. wiss. Bot.* 1872. 533—564.

[2] *Okro* or *Okra* are common names for the plant in the East and West Indies. *Bendi-kai*, a Canarese and Tamil word, is used by Europeans in the South of India.

). 1216, describes[1] in unmistakeable terms the form of the plant, its ds and fruit, which last he remarks is eaten when young and tender th meat by the Egyptians. The plant was figured among Egyptian ants in 1592 by Prosper Alpinus[2] who mentions its uses as an exrnal emollient.

It is noticed in the present work from the circumstance that it has a ace in the *Pharmacopœia of India.*

Description—The fruit is a thin capsule, 4 to 6 or more inches long d about an inch in diameter, oblong, pointed, with 5 to 7 ridges corsponding to the valves and cells, each of which latter contains a single w of round seeds. It is covered with rough hairs and is green when esh; it has a slightly sweet mucilaginous taste and a weak herbaceous lour. Like many other plants of the order, *Hibiscus esculentus* abounds all its parts, with insipid mucilage.

Microscopic Structure—A characteristic part for microscopic tamination are the hairs of the fruit. They exhibit at the base one rge cell, but their elongated and often slightly curved end is built p of a considerable number of small cells, without any solid contents. he middle and outer zone of the pericarp shows enormous holes filled p with colourless mucilage. In polarized light it is easily seen to be omposed of successive layers.

Chemical Composition — It is probable that the fruits conain the same mucilage as *Althæa*, but we have had no opportunity of nvestigating the fact. Popp who examined them green in Egypt, states[3] hat they abound in pectin, starch and mucilage. He found that when ried they afforded 2 to 2·4 per cent. of nitrogen, and an ash rich in salts f lime, potash and magnesia. The ripe seeds gave 2·4—2·5 per cent. of itrogen; their ash 24 per cent. of phosphoric acid.

Uses—The fresh or dried, unripe fruits are used in tropical countries s a demulcent like marshmallow, or as an emollient poultice, for which atter purpose the leaves may also be employed. They are more imortant from an economic point of view, being much employed for hickening soups or eaten boiled as a vegetable. The root has been ommended as a substitute for that of *Althæa.*[4] The plant yields a ood fibre.

STERCULIACEÆ.

OLEUM CACAO.

Butyrum Cacao, Oleum Theobromatis; Cacao Butter, Oil of Theobroma; F. *Beurre de Cacao;* G. *Cacaobutter, Cacaotalg.*

Botanical Origin—Cacao seeds (from which Cacao Butter is extracted) are furnished by *Theobroma Cacao* L., and apparently also by *T. leucarpum* Bernoulli, *Th. pentagonum* Bern., and *Th. Salzman-*

[1] Ibn Baytar, Sontheimer's translation, i. 9. Wustenfeld, *Geschichte d. Arab. Aerzte* 1840. 118.

[2] *De plant. Ægypt.*, Venet. 1592. cap.

[3] *Archiv der Pharmacie*, cxcv. (1871) 142.

[4] Della Sudda, *Rép. de Pharm.*, Janvier, 1860. 229.

nianum Bern.[1] These trees are found in the northern parts of South America and in Central America as far as Mexico, both in a wild state and in cultivation.

History—Cacao butter was prepared and described by Homberg[2] as early as 1695, at which time it appears to have had no particular application.

An essay published at Tübingen in 1735[3] called attention to it as "*novum atque commendatissimum medicamentum.*" A little later it is mentioned by Geoffroy[4] who says that it is obtained either by boiling or by expressing the seeds, that it is recommended as the basis of cosmetic pomades and as an application to chapped lips and nipples, and to hæmorrhoids.

Production—Cacao butter is procured for use in pharmacy from the manufacturers of chocolate who obtain it by pressing the warmed seeds. These in the shelled state yield from 45 to 50 per cent. of oil. The natural seeds consist of about 12 per cent. of shell (testa) and 88 of kernels (cotyledons).

Description—At ordinary temperatures cacao butter is a light yellowish, opaque, dry substance, usually supplied in the form of oblong tablets having somewhat the aspect of white Windsor soap. Though unctuous to touch, it is brittle enough to break into fragments when struck, exhibiting a dull waxy fracture. It has a pleasant odour of chocolate and melts in the mouth with a bland agreeable taste. Its sp. gr. is 0·961; its fusing point 29° to 30° C.

Examined under the microscope by polarized light, cacao butter is seen to consist of minute crystals. It is dissolved by 20 parts of boiling absolute alcohol, but on cooling separates to such an extent that the liquid retains not more than 1 per cent. in solution. The fat separated after refrigeration is found to have lost most of its chocolate flavour. Litmus is not altered by the hot alcoholic solution.

Cacao butter in small fragments is slowly dissolved by double its weight of benzol in the cold (10° C.), but by keeping partially separates in crystalline warts.

Chemical Composition—The fat under notice is composed in common with others, of several bodies which by saponification furnish glycerin and fatty acids. Among the latter occurs in small proportion oleic acid,[5] contained in that part of the cacao butter which remains dissolved in cold alcohol as above stated. In fact by evaporating that solution a soft fat is obtained. But the chief constituent of cacao butter appears to be stearin. Palmitin also occurs, and another compound of glycerin containing probably an acid of the same series richer in carbon,—perhaps arachic acid, $C^{20}H^{40}O^{2}$.

Uses—Cacao butter which is remarkable for having but little tendency to rancidity, has long been used in continental pharmacy; it was

[1] Bernoulli, *Uebersicht der bis jetzt bekannten Arten von Theobroma.*—Reprinted from *Denkschriften der Schweizerischen Gesellschaft für Naturwissenschaften*, xxiv. (Zürich 1869) 4°. 376.

[2] *Hist. d. l'Acad. Roy. des Sciences*, tome ii. depuis 1686 jusqu'à 1699, Paris, 1733. p. 248.

[3] B. D. Mauchart præside—dissertatio: *Butyrum Cacao.* Resp. Theoph. Hoffmann.

[4] *Tract. de Mat. Med.* ii. (1741) 409.

[5] See article *Amygdalæ dulces.*

introduced into England a few years ago as a convenient basis for suppositories and pessaries.

Adulteration—The description given of the drug sufficiently indicates the means of ascertaining its purity.

LINEÆ.

SEMEN LINI.

Linseed, Flax Seed; F. *Semence de Lin;* G. *Leinsamen, Flachssamen.*

Botanical Origin—*Linum usitatissimum* L., Common Flax, is an annual plant, native of the Old World where it has been cultivated from the remotest times. It sows itself as a weed in tilled ground and is now found in all temperate and tropical regions of the globe. Heer regards it as a variety evolved by cultivation from the perennial *L. angustifolium* Huds.

History—The history of flax, its textile fibre and seed, is intimately connected with that of human civilization. The whole process of converting the plant into a fibre fit for weaving into cloth is frequently depicted on the wall-paintings of the Egyptian tombs.[1] The grave-clothes of the old Egyptians were made of flax, and the use of the fibre in Egypt may be traced back, according to Unger,[2] as far as the 23rd century B.C. The old literature of the Hebrews[3] and Greeks contains frequent reference to tissues of flax; and fabrics woven of flax have actually been discovered together with fruits and seeds of the plant in the remains of the ancient pile-dwellings bordering the lakes of Switzerland.[4]

The seed in ancient times played an important part in the alimentation of man. Among the Greeks, Alcman in the 7th century B.C., and the historian Thucydides, and among the Romans Pliny, mention linseed as employed for human food. The roasted seed is still eaten by the Abyssinians.[5]

Theophrastus (3rd century B.C.) expressly alludes to the mucilaginous and oily properties of the seed. Pliny and Dioscorides were acquainted with its medical application both external and internal. The latter, as well as Columella, exhaustively describes flax under its agricultural aspect. In an edict of the Emperor Diocletian *De pretiis rerum venalium*[6] dating A.D. 301, linseed is quoted 150 *denarii*, sesamé seed 200, hemp seed 80, and poppy seed 150, the *modius castrensis*, equal to about 880 cubic inches.[7] The propagation of flax in Northern Europe as of so many other useful plants was promoted by Charlemagne.[8]

Description—The capsule which is globose splits into 5 carpels each containing two seeds separated by a partition. The seeds are of

[1] Wilkinson, *Ancient Egyptians*, iii. (1837) 128, &c.

[2] *Sitzungsbericht der Wiener Akademie*, xxx 1-46.

[3] Exod. ix. 31; Lev. xiii. 47, 48; Isaiah xix. 9.

[4] Heer in Trimen's *Journ. of Bot.* i. (1872) 7.

[5] A. de Candolle, *Géogr. Botanique*, 835.

[6] See p. 61, note 2.

[7] The English *imperial gallon* = 277·27 cubic inches.

[8] For further historical information on flax in ancient times, we may refer to Hehn, *Kulturpflanzen und Hausthiere* . . . Berlin 1870. 97, 430.

flattened, elongated ovoid form with an acute edge, and a slightly oblique point blunt at one end. They have a brown, glossy, polished surface which under a lens is seen to be marked with extremely fine pits. The hilum occupies a slight hollow in the edge just below the apex. The testa which is not very hard encloses a thin layer of albumen surrounding a pair of large cotyledons having at their pointed extremity a straight embryo. The seeds of different countries vary from $\frac{1}{4}$ to $\frac{1}{6}$ of an inch in length, those produced in warm regions being larger than those grown in cold. We find that 6 seeds of Sicilian linseed, 13 of Black Sea and 17 of Archangel linseed weigh respectively *one grain.*

When immersed in water, the seeds become surrounded by a thin, slippery, colourless, mucous envelope, which quickly dissolves as a neutral jelly, while the seed slightly swells and loses its polish. The seed when masticated has a mucilaginous oily taste.

Microscopic Structure—On examining the testa under almond oil or oil of turpentine, the outlines of the epidermal cells are not distinctly visible. But under dilute glycerin or in water the epidermis quickly swells up to 3 or 4 times its original thickness; on warming, the entire epidermis is resolved into mucilage, except a thin skeleton of cell-walls, which withstands even the action of caustic lye. The formation of the mucilage may be conveniently studied by the use of a solution of ferrous sulphate, with which thin sections of the testa should be moistened. Other structural peculiarities may be seen if they are imbued with concentrated sulphuric acid, washed, and then moistened with a solution of iodine. The application of polarized light is also useful. By the latter means crystalloid granules of albuminoid matter become visible if the sections are examined under oil. The tissue of the albumen and the cotyledons abounds in drops of fatty oil.

Chemical Composition—The constituent of chief importance is the fixed oil which the seed contains to about $\frac{1}{3}$ of its weight. The proportion obtained by pressure on a large scale is 20 to 30 per cent. varying with the quality of the seed. The oil when pressed without heat and when fresh has but little colour, is without unpleasant taste, and does not solidify till cooled to $-20°$ C. The commercial oil however is dark yellow and has a sharp repulsive taste and odour. On exposure to the air, especially after having been heated with oxide of lead, it quickly dries up to a transparent varnish consisting chiefly of *Linoxyn* $C^{32}H^{54}O^{11}$. The crude oil increases in weight 11 to 12 per cent. although at the same time its glycerin is destroyed by oxidation.

By saponification, linseed oil yields glycerin, and 95 per cent. of fatty acids, consisting chiefly of *Linoleic Acid*, $C^{16}H^{26}O^{2}$,[1] accompanied by some oleic, palmitic, and myristic acid. The action of the air transforms linoleic acid into the resinoid *Oxylinoleic Acid* $C^{16}H^{26}O^{4}$. Linoleic acid appears to be contained in all drying oils, notably in that of poppy seed. It is not homologous either with ordinary fatty acids or with the oleic acid of oil of almonds, $C^{18}H^{34}O^{2}$. The chemistry

[1] Formula of Süsserguth (1865); $C^{16}H^{28}O^{2}$ according to Mulder.

ıe drying oils, especially those of linseed and poppy, has been partirly investigated by Mulder.[1]

The viscid mucilage of linseed cannot be filtered till it has been ed. It contains in the dry state more than 10 per cent. of mineral ıtances, when freed from which and dried at 110° C. it correıds like althæa-mucilage, to the formula $C^{12}H^{20}O^{10}$. The seeds by ıustion with cold or warm water afford of it about 15 per cent. boiling nitric acid it yields crystals of mucic acid. Its chemical tions are therefore those of gum and not of soluble cellulose.

Linseed contains about 4 per cent. of nitrogen corresponding to ıt 25 per cent. of protein-substances. After expression of the oil e substances remain in the cake so completely that the latter conıs 5 per cent. of nitrogen, and constitutes a very important article eeding cattle.

In the ripe state linseed is altogether destitute of starch, though substance is found in the immature seed in the very cells which sequently yield the mucilage. The latter may be regarded as in logous cases to be a product of the transformation of starch.

The amount of water retained by the air-dry seed is about er cent.

The mineral constituents of linseed, chiefly phosphates of potasm, magnesium, and calcium, amount on an average to 3 per cent., l pass into the mucilage. By treating thin slices of the testa and adhering inner membrane with ferrous sulphate, it is seen that s integument is the seat of a small amount of tannin.

Production and Commerce—Flax is cultivated on the largest le in Russia, from which country there was imported into the ited Kingdom in 1872, linseed to the value of 3 millions sterling. e shipments were made in about equal proportion from the northern l the southern ports of Russia.

The imports from India in the same year amounted in value to 144,942, and from Germany and Holland to £144,108. The total port in 1872 was 1,514,947 quarters, value £4,513,842.

The cultivation of flax in Great Britain appears to be declining. e area under this crop in 1870 was 23,957 acres; in 1871, 17,366 es; in 1872, 15,357 acres; and in 1873, 14,683 acres. The lastned area reckoning the yield at 2 to 2½ quarters of seed per acre uld represent a production of about 30,000 to 38,000 quarters.

In English price-currents, eight sorts of linseed are enumerated, nely, English, Calcutta, Bombay, Egyptian, Black Sea and Azof, ersburg, Riga, Archangel. The first three appear to fetch the best prices.

Uses—In medicine, linseed is chiefly used in the form of poultice, ich may be made either of the seed simply ground or of the pulverl cake. In either case the powder should not be long stored, as the in the comminuted seed is rapidly oxidized and fatty acids proed. An infusion of the seeds called *Linseed Tea* is a common ular demulcent remedy.

[1] His numerous investigations on this ct have been published in a separate klet, of which we have before us a German translation: G. J. Mulder, *Die Chemie der austrocknenden Oele* . . Berlin, 1867, pp. 255.

Adulteration—Linseed is very liable to adulteration with other seeds, especially when the commodity is scarce. The admixture in question is due in part to careless harvesting and in part to intentional additions. In 1864 the impure condition of the linseed shipped to the English market had become so detrimental to the tradè that the importers and crushers' founded an association called *The Linseed Association of London*, by which they bound themselves to refuse all linseed containing more than 4 per cent. of foreign seeds, and this step very rapidly improved the quality of the article.[1]

As the druggist has to *purchase* linseed meal, he must of necessity rely to some extent on the character of the oil-presser from whom he derives his supplies. The presence of the seeds of *Cruciferæ* (as rape and mustard) which is common, may be recognized by the pungent odour of the essential oil which they develope in contact with water. The introduction of cereals would also be easily discovered by iodine, which strikes no blue colour in a decoction of linseed. The microscope will also afford important aid in the examination of linseed cake or meal.

ZYGOPHYLLEÆ.

LIGNUM GUAIACI.

Lignum sanctum; Guaiacum Wood, Lignum Vitæ; F. *Bois de Gayac;* G. *Guaiakholz, Pockholz.*

Botanical Origin—This wood is furnished by two West Indian species of *Guaiacum*, namely:—

1. *G. officinale* L., a middle-sized or low evergreen tree, with light blue flowers, paripinnate leaves having ovate, very obtuse leaflets in 2, less often in 3 pairs, and 2-celled fruits. It grows in Cuba, Jamaica (abundantly on the arid plains of the south side of the island), Les Gonaives in the N.W. of Hayti (plentiful), St. Domingo, Martinique, St. Lucia, St. Vincent, Trinidad, and the northern coast of the South American continent. This tree affords the Lignum Vitæ of Jamaica (of which very little is imported), a portion of that shipped from the ports of Hayti, and probably the small quantity exported by the United States of Colombia.

2. *G. sanctum* L., a tree much resembling the preceding, but distinguishable by its leaves having 3 to 4 pairs of leaflets which are very obliquely obovate or oblong, passing into rhomboid-ovate, and mucronulate; and a 5-celled fruit. It is found in Southern Florida, the Bahama Islands, Key West, Cuba, St. Domingo (including the part called Hayti) and Puerto Rico, and is certainly the source of the small but excellent Lignum Vitæ exported from the Bahamas as well as of some of that shipped from Hayti.

History—There can be no doubt but that the earliest importations of Lignum Vitæ were obtained from St. Domingo, of which island, Oviedo[2] who landed in America in 1514 mentions the tree, under the name of *Guayacan*, as a native. He points out its fruits as yellow and

[1] Greenish in *Year-Book of Pharmacy*, 1871. 590; *Pharm. Journ.* Sept. 9, 1871. 211.

[2] *Natural Hystoria de las Indias*, Toledo, 1526. fol. xxxvii.

ing two joined lupines, which could only be said with reference *ficinale* and would not apply to the ovoid, five-cornered fruits of *um*. Oviedo appears however to have been aware of two species, hich he found in Española (St. Domingo) as well as in Nagrando ua), and the other in the island of St. John (Puerto Rico), it was called *Lignum sanctum*.

first edition of Oviedo was printed in 1526; but some years is the wood must have been known in Germany, as is evident treatises written in 1517, 1518, and 1519 by Nicolaus Poll,[1] Schmaus[2] and Ulrich von Hutten.[3] The last which gives a description of the tree, its wood, bark, and medicinal pro- vas translated into English in 1533 by Thomas Paynel, canon of Abbey, and published in London in 1536 under the title—"*Of called Guaiacum that healeth the Frenche Pockes and also helpeth in the feete, the stoone, the palsey, lepree, dropsy, fallynge euyll, r dyseases.*" It was several times reprinted.

cription[4]—The wood (always known in commerce as *Lignum* imported consists of pieces of the stem and thick branches, stripped of bark, and often weighing a hundredweight each. It kably heavy and compact. Its sp. gr. which exceeds that of ods is about 1·3.

um Vitæ is mostly imported for turnery,[5] and the chips, raspings vings are the only form in which it is commonly seen in phar- A stem 7 to 8 inches in diameter cut transversely exhibits a lowish zone of sapwood about an inch wide, enclosing a sharply heartwood of a dark greenish brown. Both display alternate nd darker layers, which especially in the sapwood are further ished by groups of vessels. In this manner are formed a large of circles resembling annual rings, the general form of which is though the individual rings are by no means well defined. an 20 such rings may be counted in the sapwood of a log such ve mentioned, and more than 30 in the heartwood. The pith- tre is usually out of the axis. The medullary rays are not o the naked eye but may be seen by a lens to be very numerous idistant. The pores of the heartwood may be distinguished as ng a brownish resin, while those of the outermost layer of sap- empty.

he thickest pieces sapwood is wanting and even in stems of foot in diameter it is reduced to ⅓ of an inch. It is of looser than the heartwood and floats on water, whereas the latter sinks. pwood and heartwood owe their tenacity to a peculiar zigzag nent of the woody bundles. The sapwood is tasteless. The

n *Morbo Gallici per Lignum Guaya- cillus*, printed in 1535 but dated 17, 8 pages 8°.

rbo Gallico tractatus, Salisburgi, 1518,—reprinted in the *Aphro-* Luisinus, Lugd. Bat. 1728. 383. only seen the latter.

de Hutten equitis de Guaiaci morbo gallico liber unus, 4°. (26 Moguntiæ, 1519.

ignum Vitæ of Jamaica (*G. offici- hat of the Bahamas* (*G. sanctum*), of which authentic specimens have been kindly placed at our disposal by Mr. G. Shadbolt, display the same appearance as well as microscopic structure.

[5] Lignum Vitæ is much used for the wheels (technically "*sheares*") of ships' blocks (pulleys) the circumference of which ought to consist of the white sapwood. It is also required for caulking mallets, skittle balls and for the large balls used in American bowling alleys, for which purposes it should be as sound and homogeneous as possible.

heartwood has a faintly aromatic and slightly irritating taste, and when heated or rubbed emits a weak agreeable odour.

The bark which was formerly officinal but is now almost obsolete, is very rich in oxalate of calcium and affords upon incineration not less than 23 per cent. of ash. It contains a resin distinct from that of the wood, and also a bitter acrid principle.

Microscopic Structure—The wood consists for the most part of pointed, not very long, ligneous cells (libriform), traversed by one-celled rows of medullary rays. There are also thin layers of parenchymatous tissue, to which the zones apparent in a transverse section of the drug are due. The pitted vessels are comparatively large but not very numerous. The structure of the sapwood is the same as that of the heartwood, but in the latter the ligneous cells are filled with resin. The parenchymatous cells contain crystals of oxalate of calcium.

Chemical Composition—The only constituent of any interest is the resin which the heartwood contains to the extent of about a fourth of its weight. The sapwood afforded us 0·91 and the heartwood 0·60 per cent. of ash.

Commerce—Lignum Vitæ varies much in estimation, according to size, soundness, and the cylindrical form of the logs. The best is exported from the city of Santo Domingo whither it is brought from the interior of the island. The quantity shipped from this port during 1871 was 1494 tons.[1] That obtained from the Haytian ports of the same island is much less esteemed in the London market.

Some small wood of good quality comes from the Bahamas, and an ordinary quality, also small, from Jamaica. From the latter island, the quantity exported in 1871 was only 14 tons;[2] from the Bahamas in the same year 199 tons.[3] Lignum Vitæ was shipped from Santa Marta in 1872 to the extent of 115 tons.[4]

Uses—Guaiacum wood is only retained in the pharmacopœia as an ingredient of the Compound Decoction of Sarsaparilla. It is probably inert, at least in the manner in which it is now administered.[5]

Adulteration—In purchasing guaiacum chips it is necessary to observe that the non-resinous sapwood is absent, and still more that there is no admixture of any other wood. A spurious form of the drug seems to be by no means rare in the United States.[6]

RESINA GUAIACI.

Guaiacum Resin; F. *Résine de Gayac*; G. *Guaiakharz.*

Botanical Origin—*Guaiacum officinale* L., see preceding article.

History—Hutten[7] in 1519 stated that guaiacum wood when set on fire exudes a blackish resin which quickly hardens, but of which he

[1] *Consular Reports* presented to Parliament, Aug. 1872.

[2] Blue Book—Island of Jamaica for 1871.

[3] Blue Book for Colony of Bahamas for 1871.

[4] *Consular Reports*, Aug. 1873. 746.

[5] The ancient treatment of syphilis by guaiacum which gained for the drug such immense reputation, consisted in the administration of vast quantities of the decoction, the patient being shut up in a warm room and kept in bed.

[6] Schulz, in the (Chicago) *Pharmacist*, Sept. 1873.

[7] Op. cit. at p. 93.

new no use. The resin was in fact introduced into medicine much ater than the wood. The first edition of the *London Pharmacopœia* in hich we find the former named, is that of 1677.

Production[1]—In the island of St. Domingo whence the supplies of uaiacum resin are chiefly derived, the latter is collected from the stems f the trees, in part as a natural exudation, and in part as the result of ncisions made in the bark. In some districts as in the island of Gonave ear Port-au-Prince, another method of obtaining it is adopted. A log f the wood is supported in a horizontal position above the ground by wo upright bars. Each end of the log is then set on fire, and a large ncision having been previously made in the middle, the melted resin uns out therefrom in considerable abundance.

The resin is collected chiefly from *G. officinale*, which affords it in reater plenty than *G. sanctum*.

Description—The resin occurs in globular tears ½ an inch to 1 inch n diameter, but much more commonly in the form of large compact nasses, containing fragments of wood and bark. The resin is brittle, reaking with a clean, glassy fracture; in thin pieces it is transparent nd appears of a greenish brown hue. The powder when fresh is grey, but becomes green by exposure to light and air. It has a slight balsamic odour and but little taste, yet leaves an irritating sensation in the throat.

The resin has a sp. gr. of about 1·2. It fuses at 85° C., emitting a peculiar odour somewhat like that of benzoin. It is easily soluble in acetone, ether, alcohol, amylic alcohol, chloroform, creasote, caustic alkaline solutions, and oil of cloves; but is not dissolved or only partially by other volatile oils, benzol or bisulphide of carbon. By oxidizing agents it acquires a fine blue colour, well shown when a fresh alcoholic solution is allowed to dry up in a very thin layer and this is then sprinkled with a dilute alcoholic solution of ferric chloride. Reducing agents of all kinds, and heat produce decoloration. An alcoholic solution may be thus blued and decolorized several times in succession, but it loses at length its susceptibility. This remarkable property of guaiacum was utilized by Schönbein in his well-known researches on ozone.

Chemical Composition—The composition of guaiacum resin was ascertained by Hadelich (1862) to be as follows:—

Guaiaconic Acid	70·3
Guaiaretic Acid	10·5
Guaiac Beta-resin	9·8
Gum	3·7
Ash constituents	0·8
Guaiacic Acid, colouring matter (Guaiac yellow), and impurities	4·9
	100·0

If the mother liquor obtained in the preparation of the potassium lt of guaiaretic acid (*vide infra*) is decomposed by hydrochloric acid, nd the precipitate washed with water, ether will extract from the mass *uaiaconic Acid*, a compound discovered by Hadelich, having the formula $^{20}H^{20}O^{10}$. It is a light brown, amorphous substance, fusing at 100° C.

[1] We have to thank Mr. Eugène Nau of rt-au-Prince for the information given under this head, as well as for some interesting specimens.

it is without acid reaction but decomposes alkaline carbonates, forming uncrystallizable salts easily soluble in water or alcohol. It is insoluble in water, benzol, or bisulphide of carbon, but dissolves in ether, chloroform, acetic acid or alcohol. With oxidizing agents it acquires a transient blue tint.

Guaiaretic Acid, $C^{20}H^{26}O^4$, discovered by Hlasiwetz in 1859, may be extracted from the crude resin by alcoholic potash or by quick lime. With the former it produces a crystalline salt; with the latter an amorphous compound: from either, the liquid which contains chiefly a salt of guaiaconic acid, may be easily decanted. Guaiaretic acid is obtained by decomposing one of the salts referred to with hydrochloric acid, and crystallizing from alcohol. The crystals, which are soluble also in ether, benzol, chloroform, carbon bisulphide or acetic acid, but neither in ammonia nor in water, melt below 80° C. and may be volatilized without decomposition. The acid is not coloured blue by oxidizing agents.

After the extraction of the guaiaconic acid there remains a substance insoluble in ether to which the name *Guaiac Beta-resin* has been applied. It dissolves in alcohol, acetic acid or alkalis, and is precipitated by ether, benzol, chloroform or carbon bisulphide in brown flocks, the composition of which appears not greatly to differ from that of guaiaconic acid.

Guaiacic Acid, $C^{12}H^{16}O^6$, obtained in 1841 by Thierry from guaiacum wood or from the resin, crystallizes in colourless needles. Hadelich was not able to obtain more than one part from 20,000 of guaiacum resin.

Hadelich's *Guaiac-yellow*, the colouring matter of guaiacum resin, first observed by Pelletier, crystallizes in pale yellow quadratic octohedra, having a bitter taste. Like the other constituents of the resin, it is not a glucoside.

The decomposition-products of guaiacum are of peculiar interest. On subjecting the resin to dry distillation in an iron retort and rectifying the distillate, *Guaiacene* (*Guajol* of Völckel), C^5H^8O, passes over at 118° C. as a colourless neutral liquid having a burning aromatic taste.

At 205°—210° C., there pass over other products, *Guaiacol* (or *Pyroguaiacic Acid* or *Guaiacyl-hydride*), $C^7H^8O^2$, and *Kreosol*, $C^8H^{10}O^2$. Both are thickish, aromatic, colourless liquids, which become green by caustic alkalis, blue by alkaline earths, and are similar in their chemical relations to eugenic acid. Guaiacol has been prepared synthetically by Gorup-Besanez (1868) by combining iodide of methyl, CH^3I, with pyrocatechin, $C^6H^6O^2$.

After the removal by distillation of the liquids just described, there sublime upon the further application of heat, pearly crystals of *Pyroguaiacin*, $C^{38}H^{44}O^6$, an inodorous substance melting at 180° C. The same compound is obtained together with guaiacol by the dry distillation of guaiaretic acid. Pyroguaiacin is coloured green by ferric chloride, and blue by warm sulphuric acid. The similar reactions of the crude resin are probably due to this substance (Hlasiwetz).

Beautiful coloured reactions are likewise exhibited by two new acids which Hlasiwetz and Barth obtained (1864) in small quantity together with traces of fatty volatile acids, by melting purified resin of guaiacum with potassium hydrate. One of them is isomeric with pyrocatechuic acid.

Uses—Guaiacum resin is reputed diaphoretic and alterative. It is frequently prescribed in cases of gout and rheumatism.

ion—The drug is sometimes imported in a very foul con-
;ely contaminated with impurities arising from a careless
lection.

RUTACEÆ.

CORTEX ANGOSTURÆ.

ria; *Angostura Bark, Cusparia Bark, Carony Bark;*
F. *Ecorce d'Angusture*; G. *Angostura-Rinde.*

l Origin—*Galipea Cusparia* St. Hilaire (*G. officinalis*
plandia trifoliata Willd.), a small tree, 12 to 15 feet high,
3 to 5 inches in diameter, growing in abundance on the
San Joaquin de Caroni in Venezuela, between 7° and 8°
ding to Hancock,[1] who was well acquainted with the tree,
nd in the Missions of Tumeremo, Uri, Alta Gracia, and
icts lying eastward of the Caroni and near its junction
noko. The bark is brought into commerce by way of

-Angostura Bark is said to have been used in Madrid by
ly as 1759[2] (the year before he left Spain for South
, it was certainly unknown to the rest of Europe until
Its real introducer was Brande, apothecary to Queen
, father of the distinguished chemist of the same name,
ntion to some parcels of the bark imported into England
the same year a quantity was sent to a London drug firm
of Trinidad who describes it[4] as brought to that island
ra by the Spaniards. The drug continued to arrive in
· by way of Spain or England, and its use was gradually
South America it is known as *Quina de Caroni* and
Angostura.

on—The bark occurs in flattish or channelled pieces, or in
as much as 6 inches in length and mostly shorter. The
are an inch or more in width and ⅛ of an inch in thick-
ter side of the bark is coated with a yellowish-grey corky
oft enough to be removeable with the nail, and then dis-
c brown, resinous under surface. The inner side is light
rough, slightly exfoliating surface indicating close adhe-
ood, strips of which are occasionally found attached to it
cut edge also shows that it is not very easily detached.
a short, resinous fracture and displays on its transverse
defined white points, due to deposits of oxalate of calcium.
r taste and a nauseous musty odour.

pic Structure—The most striking peculiarity is the great

n the Orayuri or Angustura
ans. of Medico-Botanical
—Hancock endeavoured to
tinct from *G. Cusparia* St.
nd Don who subsequently
ecimens decided that the
me. With the assistance
also have examined (1871)

Hancock's plant, comparing it with his figure and other specimens, and have arrived at the conclusion that it is untenable as a distinct species.—D. H.

[2] Martiny, *Encyklopädie*, i. (1843) 242.

[3] Brande, *Experiments and Observations on the Angustura Bark.* 1791. 2nd ed. 1793.

[4] *London Med. Journ* x. (1789) 154.

number of oil-cells scattered through the tissue of the bark. They are not much larger than the neighbouring parenchymatous cells and are loaded with yellowish essential oil or small granules of resin. Numerous other cells contain bundles of needle-shaped crystals of oxalate of calcium or small starch granules. The liber exhibits bundles of yellow fibres, to which the foliaceous fracture of the inner bark is due.

Chemical Composition—Angostura bark owes its peculiar odour to an essential oil which it was found by Herzog[1] to yield to the extent of $\frac{3}{4}$ per cent. According to this chemist it has the composition $C^{13}H^{24}O$; it is probably a mixture of a hydrocarbon ($C^{10}H^{8}$) with an oxygenated oil. Its boiling point is 266° C.

The bitter taste of the bark is attributed to a substance pointed out in 1833 by Saladin and named *Cusparin*. It is said to be crystalline, neutral, melting at 45° C., soluble in alcohol, sparingly in water, precipitable by tannic acid. The bark is stated to yield it to the extent of 1·3 per cent. Herzog endeavoured to prepare it but without success. A cold aqueous infusion of angostura bark yields an abundant red-brown precipitate with ferric chloride. Thin slices of the bark are not coloured by solution of ferrous sulphate, so that tannin appears to be absent.

Uses—Angostura bark is a valuable tonic in dyspepsia, dysentery and chronic diarrhœa, but is falling into disuse.

Adulteration—About the year 1804, a quantity of a bark which proved to be that of *Strychnos Nux Vomica* reached Europe from India, and was mistaken for Cusparia. The error occasioned great alarm and some accidents, and the use of angostura was in some countries even prohibited. The means of distinguishing the two barks (which are not likely to be again confounded) are amply contained in the above-given descriptions and tests.

FOLIA BUCHU.

Folia Bucco; Buchu, Bucchu, Bucha or Buka Leaves; F. *Feuilles de Bucco;* G. *Bukublätter.*

Botanical Origin—The Buchu leaves of medicine are afforded by three species of *Barosma*.[2] The latter are erect shrubs some feet in height with glabrous rod-like branches, opposite leaves furnished with conspicuous oil-cells on the toothed margin as well as generally on the under surface. The younger twigs and several parts of the flower are also provided with oil-cells. The white flowers with 5-partite calyx, and the fruit formed of five erect carpels, are often found, together with small leafy twigs, in the drug of commerce.

The leaves of the three species referred to may be thus distinguished:—

1. *Barosma crenulata* Hook. (*B. crenata* Kunze).—Oblong, oval, or obovate, obtuse, narrowed towards the base into a distinct petiole; margin serrulate or crenulate; dimensions, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long, $\frac{3}{16}$ to $\frac{4}{10}$ of an inch wide.

[1] *Archiv d. Pharm.* xciii. (1858) 146.

[2] From βαρὺς, *heavy*, and ὀσμὴ, *odour*.

2. *B. serratifolia* Willd.—Linear-lanceolate, equally narrowed towards either end, three-nerved, apex truncate always furnished with a oil-cell; margin sharply serrulate; 1—1½ inches long by about $\frac{3}{16}$ of an inch wide.

3. *B. betulina* Bartling.—Cuneate-obovate, apex recurved; margin sharply denticulate, teeth spreading; ½ to ¾ of an inch long by $\frac{3}{16}$ to $\frac{4}{16}$ wide. Substance of the leaf more harsh and rigid than in the preceding.

B. crenulata and *B. betulina* grow in the Divisions of Clanwilliam and Worcester, north and north-east of Cape Town, and the former even in Table Mountain close to the capital; *B. serratifolia* is found in the Division of Swellendam further south.

History—The use of Buchu leaves was learnt from the Hottentots by the colonists of the Cape of Good Hope. The first importations of the drug were consigned to the house of Reece & Co. of London, who introduced it to the medical profession in 1821.[1] The species appears to have been *B. crenulata.*

Description—In addition to the characters already pointed out, we may observe that buchu leaves of either of the kinds mentioned are smooth and glabrous, of a dull yellowish-green hue, somewhat paler on the under side, on which oil-cells in considerable number are perceptible.

The leaves of *B. crenulata* vary in shape and size in different parcels, in some the leaves being larger and more elongated than in others, probably according to the luxuriance of the bushes in particular localities. Those of *B. serratifolia* and *B. betulina* present but little variation. Each kind is always imported by itself. Those of *B. betulina* are the least esteemed and fetch a lower price than the others, yet appear to be quite as rich in essential oil.

Buchu leaves have a penetrating peculiar odour and a strongly aromatic taste.

Microscopic Structure—The essential oil is contained in large cells close beneath the epidermis of the under side of the leaf. The oil-cells are circular and surrounded by a thin layer of smaller cells; they consequently partake of the character of the oil-ducts in the aromatic roots of *Umbelliferæ* and *Compositæ.* The latter however are elongated.

The upper side of the leaf of *Barosma* exhibits an extremely interesting peculiarity.[2] There is a colourless layer of cells separating the epidermis from the green inner tissue (mesophyllum). If the leaves are examined under alcohol or almond-oil the colourless layer is seen to be very narrow, and the thin walls of its cells shrunken and not clearly distinguishable. If the transverse sections are examined under water, these cells immediately swell up and become strongly distended, giving off an abundance of mucilage, the latter being afforded by the solution of the very cell-walls. The mucilage of buchu leaves thus originates in the same way as in flax seed or quince seed, but in the former the epidermis is thrown off without alteration. We are not aware that other mucilaginous leaves possess a similar structure, at least not those of *Althæa officinalis* and of *Sesamum* which we examined.

Chemical Composition—The leaves of *B. betulina* afforded us by

[1] R. Reece, *Monthly Gazette of Health* for Feb. 1821. 799.

[2] Flückiger in *Schweiz. Wochenschrift für Pharm.* Dec. 1873, with plate.

distillation 1·56 per cent. of volatile oil,[1] which has the odour rather of peppermint than of buchu and deviates the ray of polarized light considerably to the left. On exposure to cold it furnishes a camphor which after re-solution in spirit of wine, crystallizes in needle-shaped forms. After repeated purification in this manner, the crystals of *Barosma Camphor* have an almost pure peppermint odour; they fuse at 85° C. and begin to sublime at 110° C. After fusion they again solidify only at 50° C. Submitted to elementary analysis, the crystals yielded us 74·08 per cent. of carbon and from 9 to 10 per cent. of hydrogen.[2] Barosma camphor is abundantly soluble in bisulphide of carbon.

The crude oil from which the camphor has been separated has a boiling point of about 200° C., quickly rising to 210° or even higher. That which distilled between these temperatures was treated with sodium, rectified in a current of common coal gas and submitted to elementary analysis, afforded us 77·86 per cent. of carbon and 10·58 of hydrogen. The formula $C^{10}H^{16}O$ would require 78·94 of carbon and 10·53 of hydrogen.

On addition of perchloride of iron an aqueous infusion of buchu leaves assumes a dingy brownish green colour changing to red by an alkali. The infusion added to a concentrated solution of acetate of copper causes a yellow precipitate[3] which dissolves in caustic potash, affording a green solution. This may be due to the presence of a substance of the quercitrin or rutin class.

When the leaves are infused in warm water, the mucilage noticed under the microscope may easily be pressed out. It requires for precipitation a large amount of alcohol, being readily miscible with dilute alcohol. Neutral acetate of lead produces a yellow precipitate in an infusion of the leaves; the liquid affords a precipitate by a subsequent addition of *basic* acetate of lead. The latter precipitate is (probably) due to the mucilage, that afforded by neutral acetate partly to mucilage and partly, we suppose, to rutin or an allied substance. Yet the mucilage of buchu leaves is of the class which is not properly dissolved by water, but only swells up like tragacanth.

The leaves of *B. crenulata* afford upon incineration 4·7 per cent. of ash.

The *Diosmin* of Landerer[4] is entirely unknown to us.

Commerce—The export of Buchu from the Cape Colony in 1872 was 379,125 lb., about one-sixth of which quantity was shipped direct to the United States.[5]

Uses—Buchu is principally administered in disorders of the urinogenital organs. It is reputed diuretic and diaphoretic. In the Cape Colony the leaves are much employed as a popular stimulant and stomachic, infused in water, sherry or brandy. They are also extensively used in the United States, both in regular medicine and by the vendors of secret remedies.

[1] Messrs. Allen and Hanburys operating on larger quantities obtained 1·63 per cent.

[2] Our supply of the substance having been exhausted by two analyses we cannot regard the above figures as sufficient for the calculation of a formula.

[3] It seems *green* as long as it is in the blue cupric liquid.

[4] Gmelin's *Chemistry*, xviii. 194.

[5] *Blue Book* published at Cape Town, 1873.

Substitutes—The leaves of *Empleurum serrulatum* Ait., a small hrub of the same order as *Barosma* and growing in the same ocalities, have been imported rather frequently of late and sold as *Buchu*. They have the same structure as regards mucilage, and nearly he same form as those of *B. serratifolia*, but are easily distinguished. They are still narrower, and often longer than those of *B. serratifolia*, nd terminate in an *acute* point *without an oil-duct;* they have a itterish taste and a different odour from buchu. The flowers of *Empleurum* are still more distinct, for they are apetalous and reddish rown. The fruit consisting of a single, compressed, oblong carpel, erminated by a flat sword-shaped horn, is quite unlike that of buchu.

The leaves of *Barosma Eckloniana* Berg (regarded by Sonder[1] as a orm of *B. crenulata*) have to our knowledge been imported on one ccasion (1873). They are nearly an inch long, oval, *rounded at the ase*, strongly crenate, and grow from *pubescent* shoots.

We have seen other leaves which had been imported from South Africa and offered as buchu; but though probably derived from allied enera they were not to be mistaken for the genuine drug.

RADIX TODDALIÆ.

Botanical Origin—*Toddalia aculeata* Pers., a ramous prickly bush, often climbing over the highest trees, common in the southern parts of the Indian Peninsula as the Coromandel Coast, South Concans and Canara, also found in Ceylon, Mauritius, the Indian Archipelago and Southern China.

History—The pungent aromatic properties which pervade the plant but especially the fresh root-bark are well known to the natives of India and have been utilized in their medical practice. They have also attracted the attention of Europeans, and the root of the plant is now recognized in the *Pharmacopœia of India*.

It is from this and other species of *Toddalia* or from the allied genus *Zanthoxylum*[2] that a drug is derived which under the name of *Lopez Root* had once some celebrity in Europe. This drug which was more precisely termed *Radix Indica Lopeziana* or *Root of Juan Lopez Pigneiro*, was first made known by the Italian physician Redi;[3] who described it in 1671 from specimens obtained by Pigneiro at the mouth of the river Zambesi in Eastern Africa,—the very locality in which in our times *Toddalia lanceolata* Lam. has been collected by Dr. Kirk.[4] It was actually introduced into European medicine by Gaubius[5] in 1771 as a remedy for diarrhœa, and acquired so much reputation that it was admitted to the Edinburgh Pharmacopœia of 1792. The root appears to have been sometimes imported from Goa, but its place of growth and botanical origin were entirely unknown, and it was always extremely

[1] Harvey and Sonder, *Flora Capensis*, i. (1859-60) 323.

[2] The root of a *Zanthoxylum* sent to us from Java by Mr. Binnendyk of the Buitenzorg Botanical Garden has exactly the aspect of that of *Toddalia*. The root of *Z. Bungei* which we have examined in the fresh state is also completely similar. It is covered with a soft, corky, yellow bark having a very bitter taste with a strong pungency like that of pellitory.

[3] *Esperienze intorno a diverse cose naturali*, Firenze, 1671. 121.

[4] Oliver, *Flor. of Trop. Africa*, i. (1868) 307.

[5] *Adversaria*, 80.

rare and costly.[1] It has long been obsolete in all countries except Holland, where until recently it was to be met with in the shops. The *Pharmacopœa Neerlandica* of 1851 says of it "*Origo botanica perquam dubia.—Patria Malacca ?*"

Description—The specimen of the root of *Toddalia aculeata* which we have examined was collected for us by Dr. G. Bidie of Madras whose statements regarding the stimulant and tonic action of the drug may be found in the *Pharmacopœia of India*, p. 442. It is a dense woody root in cylindrical, flexuous pieces, which have evidently been of considerable length and are from $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter, covered with bark $\frac{1}{16}$ to $\frac{1}{12}$ of an inch in thickness. The bark has a soft, dull yellowish, suberous coat, wrinkled longitudinally, beneath which is a very thin layer of a bright yellow colour, and still lower and constituting two-thirds or more of the whole, is the firm, brown middle cortical layer and liber which is the part chiefly possessing the characteristic pungency and bitterness of the drug. The yellow corky coat is however not devoid of bitterness. The wood is hard, of a pale yellow, and without taste and smell. The pores of the wood which are rather large, are arranged in concentric order and traversed by numerous narrow medullary rays.

In a letter which Frappier[2] wrote to Guibourt from the island of Réunion where *Toddalia aculeata* is very common, he states that the roots of the plant are of enormous length (*longueur incroyable*) and rather difficult to get out of the basaltic rock into the fissures of which they penetrate. Mr. J. Horne of the Botanical Garden, Mauritius, has sent us a specimen of the root of this plant, the bark of which is of a dusky brown, with the suberous layer but little developed.

Microscopic Structure—We have examined the root for which we are indebted to Dr. Bidie, and may state that its cortical tissue is remarkable by the number of large cells filled with resin and essential oil; they are scattered through the whole tissue, the cork excepted. The parenchymatous cells are loaded with small starch granules or with crystals of oxalate of calcium. The vessels of younger roots abound in yellow resin.

Chemical Composition—None of the constituents of the Toddalia root of India have yet been satisfactorily examined. The bark contains an essential oil, which would be better extracted from fresh than from dry material. The tissue of the bark is but little coloured by salts of iron. In the aqueous infusion, tannic acid produces an abundant precipitate, probably of an indifferent bitter principle rather than of an alkaloid. We have been unable to detect the presence in the bark of berberine.

Lopez root was examined in Wittstein's laboratory by Schnitzer[3] who found that the bark contains in addition to the usual substances a large proportion of resin,—a mixture probably of two or three different bodies. The essential oil afforded by the bark had an odour resembling cinnamon and melissa.

[1] Our friend Dr. de Vry informs us that he remembers the price in Holland in 1828 being equivalent to about 24*s.* the ounce!

[2] *Journ. de Pharm.* v. (1867) 403.

[3] Wittstein's *Vierteljahresschrift für prakt. Pharm.* xi. (1862) i.—The drug examined was the Lopez root sold at that period at Amsterdam.

s—The drug has been introduced into the *Pharmacopœia of* niefly upon the recommendation of Dr. Bidie of Madras, who s it of great value as a stimulating tonic. The bark rasped or rom the woody root is the only part that should be used.

AURANTIACEÆ.

FRUCTUS LIMONIS.

Lemon ; F. Citron, Limon ; G. Citrone, Limone.

inical Origin—*Citrus Limonum* Risso (*C. medica* var. *β* Linn.), ree 10 to 15 feet in height, planted here and there in gardens sub-tropical countries, but cultivated as an object of industry Iediterranean coast between Nice and Genoa, in Calabria, Sicily, d Portugal.

.ree which is supposed to represent the wild state of the lemon ɜ, and as it seems to us after the examination of numerous ıs in the herbarium of Kew, of the citron (*Citrus medica* Risso) native of the forests of Northern India, where it occurs in the ıf Kumaon and Sikkim.

:ultivated lemon-tree is of rather irregular growth, with foliage ıt pallid, sparse, and uneven, not forming the fine, close head of en that is so striking in the orange-tree. The young shoots are ll purple; the flowers, which are produced all the year except ıe winter and are in part hermaphrodite and in part unisexual, : corolla externally purplish, internally white, and a delicate stinct from that of orange blossom. The fruit is pale yellow, ıually crowned by a nipple.

ory—The name of the lemon in Sanskrit is *Nimbùka ;* in Hin- *Limbu, Limu,* or *Ninbu.* From these sounds the Arabians formed l *Limun,* which has passed into the languages of Europe.

.emon was unknown to the inhabitants of ancient Greece and ɔut it is mentioned in the Book of Nabathæan Agriculture,[1] supposed to date from the 3rd or 4th century of our era. The tion of the tree to Europe is due to the Arabians, yet at what period is somewhat doubtful. The geographer Èdrisi,[2] who .t the court of Roger II., king of Sicily, in the middle of the tury, mentions the lemon (*limouna*) as a very sour fruit of the ı apple which was one of the productions of Mansouria on the or Indus ; and he speaks of it in a manner that leads one to ras not then known in Europe. This is the more probable from that there is no mention either of lemon or orange in a letter ı.D. 1239 concerning the cultivation of the lands of the Emperor k II. at Palermo,[3] a locality in which these fruits are now pro- large quantity.

he other hand the lemon is noticed at great length by Ibn f Malaga who flourished in the first half of the 13th century. ɜ cultivation in Spain at that period there is no actual mention.[4]

Geschichte der Botanik, iii. (1856)

phie d'Edrisi, traduite par Jau- 36) 162.

[3] Huillard-Bréholles, *Historia diplomatica Friderici secundi*, Paris, v. 571.

[4] *Heil- und Nahrungsmittel von Ebn Baithar*, übersetzt von Sontheimer, ii. (1842) 452.

There is distinct evidence that the tree was grown on the Riviera of Genoa about the middle of the 15th century, since *Limones* and also *Citri* are mentioned in the manuscript *Livre d'Administration* of the city of Savona, under date 1468.[1] The lemon was cultivated as early as 1494 in the Azores, whence the fruit used to be largely shipped to England; but since the year 1838 the exportation has totally ceased.[2]

Description—The fruit of *Citrus Limonum* as found in the shops[3] is from about 2 to 4 inches in length, egg-shaped with a nipple more or less prominent at the apex; its surface of a pale yellow, is even or rugged, covered with a polished epidermis. The parenchyme within the latter abounds in large cells filled with fragrant essential oil. The roughness of the surface of the rind is due to the oil-cells. The peel which varies considerably in thickness but is never so thick as that of the citron, is internally white and fibrous, and is adherent to the pale-yellow pulp. The latter is divided into 10 or 12 segments each containing 2 or 3 seeds. It abounds in a pale-yellow acid juice having a pleasant sour taste and a slight peculiar odour quite distinct from that of the peel. When removed from the pulp by pressure, the juice appears as a rather turbid yellowish fluid having a sp. gr. which varies from 1·040 to 1·045, and containing in each fluid ounce from 40 to 46 grains of citric acid, or about 9½ per cent.[4] Lemon juice (*Succus limonis*) for administration as a medicine should be pressed as wanted from the recent fruit whenever the latter is obtainable.

The peel (*Cortex limonis*) cut in somewhat thin ribbons from the fresh fruit is used in pharmacy and is far preferable to that sold in a dried state.

Microscopic Structure of the peel.—The epidermis exhibits numerous stomata; the parenchyme of the pericarp encloses large oil-cells, surrounded by small tabular cells. The inner spongy tissue is built up of very remarkable branched cells, separated by large intercellular spaces. A solution of iodine in iodide of potassium imparts to the cell-walls a transient blue coloration. The outer layers of the parenchymatous tissue contain numerous yellowish lumps of a substance which assumes a brownish hue by iodine and yields a yellow solution if potash be added. Alkaline tartrate of copper is reduced by this substance, which probably consists of hesperidin. There also occur large crystals of oxalate of calcium, belonging to the monoclinic system. The interior tissue is irregularly traversed by small vascular bundles.

Chemical Composition—The peel of the lemon abounds in essential oil which is a distinct article of commerce, and will be described hereafter.

Lemons as well as other fruits of the genus *Citrus* contain a bitter principle, *Hesperidin*, our knowledge of which is still very imperfect. It was first obtained in 1827 by *Lebreton*, but not in a state of purity. He supposed the bitter taste of the needle-shaped crystals of his hesperidin to be due to an accompanying bitter principle; *Lepage* likewise stated hesperidin to be a tasteless body. *Dehn* in 1866 examined the products of decomposition of hesperidin, which were formed by boiling

[1] Gallesio, *Traité du Citrus* (1811) 89, 105.

[2] Consul Smallwood, in *Consular Reports*, Aug. 1873. 986.

[3] There are many kinds of lemon as well as of orange which are never seen in commerce. Risso and Poiteau enumerate 25 varieties of the former and 30 of the latter.

[4] Stoddart, in *Pharm. Journ.* x. (1869) 203.

it with dilute sulphuric acid. He analysed the peculiar sugar, $C^{12}H^{24}O^{10} + H^2O$, thus obtained, but not the other product of this reaction, nor hesperidin itself.

Brandes in 1841 also pointed out the existence of a bitter principle, to which he applied the name of *Aurantiin*. In 1840 *Bernays* obtained *Limonin* from kernels of lemons or sweet oranges, likewise a bitter principle, to which *Schmidt* (1844) assigned the formula $C^{44}H^{52}O^{14}$. Lastly, J. E. de Vry in 1866 removed a crystallized bitter substance from the flowers of *Citrus decumana* L. grown in Java.

Whether these bodies are but one and the same is a question which remains to be investigated. Lebreton's hesperidin is soluble in ammonia with a greenish yellow colour. To it perhaps is due the fine yellow tint that is produced in the white parenchyme of the fruit when brought into contact with an alkali or with vapour of ammonia.

On addition of ferric chloride, thin slices of the peel are darkened, owing probably to a kind of tannic matter.

Lemon juice, some of the characters of which have been already noticed, is an important article in a dietetic point of view, being largely consumed on shipboard for the prevention of scurvy. In addition to citric acid it contains 3 to 4 per cent. of gum and sugar, and 2·28 per cent. of inorganic salts, of which according to Stoddart only a minute proportion is potash. Cossa [1] on the other hand who has recently studied the products of the lemon tree with much care, has found that the ash of dried lemon juice contains 54 per cent. of potash, besides 15 per cent. of phosphoric acid.

Stoddart has pointed out the remarkable tendency of citric acid to undergo decomposition,[2] and has proved that in lemons kept from February to July this acid generally decreases in quantity, at first slowly but afterwards rapidly, until at the end of the period it entirely ceases to exist, having been all split up into glucose and carbonic acid. At the same time the sp. gr. of the juice was found to have undergone but slight diminution:—thus it was 1·044 in February, 1·041 in May, and 1·027 in July, and the fruit had hardly altered in appearance. Lemon juice may with some precautions be kept unimpaired for months or even years. Yet it is capable of undergoing fermentation by reason of the sugar, gum, and albuminoid matters which it contains.

Commerce—Lemons are chiefly imported from Sicily, to a smaller extent from the Riviera of Genoa and from Spain. From the published statistics of trade, in which lemons are classed together with oranges under one head, it appears that these fruits are being imported in increasing quantities. The value of the shipments to the United Kingdom in 1872 (largely exceeding those of any previous year) was £1,154,279. Of this sum, £986,796 represents the value of the oranges and lemons imported from Spain, Portugal, the Canary Islands and Azores; £155,330 the shipments of the same fruit from Italy; and £3,825 those from Malta.

Uses—Lemon peel is used in medicine solely as a flavouring ingredient. Freshly prepared lemon juice is often administered with

[1] *Gazzetta Chimica Italiana*, ii. (1872) 265; *Journ. of Chem. Soc.* xi. (1873) 402.

[2] Stoddart's statement that if potash be added to lemon juice, *oxalic acid* may be detected in the mixture after a few days, is not supported by our observations.

an alkaline bicarbonate in the form of an effervescing draught, or in a free state.

Concentrated lemon juice or lime juice is imported for the purpose of making citric acid; it is derived not only from the lemon, but also from the lime and bergamot.

OLEUM LIMONIS.

Oleum Limonum; Essential Oil or Essence of Lemon; F. *Essence de Citron;* G. *Citronenöl.*

Botanical Origin—*Citrus Limonum* Risso (see p. 103).

History—The chemists of the 16th century were well acquainted with the method of extracting essential oils by distillation. Besson in his work *L'art et moyen parfaict de tirer huyles et eaux de tous medicaments simples et oleogineux* published at Paris in 1571, mentions *lemon* (citron) and orange-peel among the substances subjected to this process. Giovanni Battista Porta,[1] a learned Neapolitan writer, describes the method of preparing *Oleum ex corticibus Citri* to consist in removing the peel of the fruit with a rasp and distilling it so comminuted with water; and adds that the oils of lemon and orange may be obtained in the same manner. Essence of lemon of two kinds, namely *expressed* and *distilled*, was sold in Paris in the time of Pomet, 1692.

Production—Essential oil of lemon is manufactured in Sicily, at Reggio in Calabria, and at Mentone and Nice in France.

The lemons are used while still rather green and unripe, as being richer in oil than when quite mature. Only the small and irregular fruit such as is not worth exporting, is employed for affording the essence.

The process followed in Sicily and Calabria may be thus described;[2] it is performed in the months of November and December.

The workman first cuts off the peel in *three* thick longitudinal slices, leaving the central pulp of a three-cornered shape with a little peel at either end. This central pulp he cuts transversely in the middle, throwing it on one side and the pieces of peel on the other. The latter are allowed to remain till the next day and are then treated thus:—the workman seated holds in the palm of his left hand a flattish piece of sponge, wrapping it round his fore-finger. With the other he places on the sponge one of the slices of peel, the outer surface downwards, and then presses the zest-side (which is uppermost) so as to give it for the moment a convex instead of a concave form. The vesicles are thus ruptured, and the oil which issues from them is received in the sponge with which they are in contact. Four or five squeezes are all the workman gives to each slice of peel, which done he throws it aside. Though each bit of peel has attached to it a small portion of pulp, the workman contrives to avoid pressing the latter. As the sponge gets saturated the workman wrings it forcibly, receiving its contents in a coarse earthen

[1] *Magiæ Naturalis libri xx.* Neapoli, 1589. 182.

[2] Through the kindness of Signor Mallandrino of Giampilieri near Messina, I had the pleasure of seeing how the essence is made. Though the time of my visit (13 May 1872) was not that of the manufacture, Signor M. sent for one of his workmen, and having procured a few lemons, set him to work on them in order that I might have ocular demonstration of the process.—D. H.

ded with a spout; in this rude vessel which is capable of least three pints, the oil separates from the watery liquid mpanies it, and is then decanted.

ld is stated to be very variable, 400 fruits affording 9 to 14 essence. The prisms of pulp and the exhausted pieces of bmitted to pressure in order to extract from them lemon juice, d to be also subjected to distillation. The foregoing is termed *process;* it is also applied to the orange. It appears rude and ut when honestly performed it yields an excellent product.

e of lemon is prepared at Mentone and Nice by a different The object being to set free and to collect the oil contained in s of the peel, an apparatus is employed which may be thus —a stout saucer or shallow basin of pewter, about 8½ inches r with a lip on one side for convenience of pouring. Fixed in a of this saucer are a number of stout, sharp, brass pins p about half an inch; the centre of the bottom is deepened about an inch in diameter and five inches in length, closed er end. This vessel which is called an *écuelle à piquer*, has ome resemblance to a shallow, dish-shaped funnel, the tube of losed below.

rkman takes a lemon in the hand, and rubs it over the sharp ng it round so that the oil-vessels of the entire surface may ed. The essential oil which is thus liberated is received in whence it flows down into the tube; and as this latter becomes s poured into another vessel that it may separate from the eous liquid that accompanies it. It is finally filtered and is n as *Essence de Citron au zeste.* A small additional produce es obtained by immersing the scarified lemons in warm water ting the oil which floats off.

d kind of essence termed *Essence de Citron distillée* is obtained g the surface of fresh lemons, or of those which have been to the process just described, on a coarse grater of tinned iron, the portion of peel richest in essential oil is removed. This l is subjected to distillation with water and yields a colourless very inferior fragrance which is sold at a low price.

iption[1]—The oil obtained by the sponge process and that of *à piquer* are mobile liquids of a faint yellow colour, of ex- grance and bitterish aromatic taste.

ifferent specimens which we have examined, are readily mis- bisulphide of carbon but dissolve sparingly in spirit of wine An equal weight of the oil and of spirit of wine forms a xture. No peculiar coloration is produced by mixture with e of iron.

ls are dextrogyre, but differ in their rotatory power, as may be by the following results, which we obtained by examining column 50 millimetres long in the polaristrobometer of Wild.

imens of the *Essence au zeste Essence distillée* of guaranteed we to thank M. Médecin, dis- ses, Mentone; and Messrs. G. gli for an authentic sample of the essence made by the sponge process in their establishment at Reggio. We have also had a small quantity prepared by the *écuelle* by one of ourselves near Mentone, 15 June 1872.—D. H.

The oil of Signori Panuccio, due to the sponge-process (p. 107, note 1), deviated 20.9°, that of Monsieur Médicin (*Essence de Citron au zeste*) obtained by the *écuelle à piquer* deviated 33·4° and his distilled oil 28·3°.

Chemical Composition—Most essential oils of the *Aurantiaceæ* agree with the formula $C^{10}H^{16}$; the differences which they exhibit, chiefly concern their optical properties, odour and colour. The boiling point varies about from 170° to 180° C., the sp. gr. between 0·83 and 0·88. These oils are probably in many cases rather a mixture of isomeric hydrocarbons than individual substances. They also contain a small proportion of oxygenated oils, not yet well known; of these we may infer the presence either from analytical results or simply from the fact, that the crude oils are altered by metallic sodium. If they are purified by repeated rectification over that metal, they are finally no longer altered by it. Oils thus purified cease to possess their original fragrance, and often resemble oil of turpentine, with which they agree in composition and general chemical behaviour.

As to *Essential oil of lemons* it easily yields the crystalline compound $C^{10}H^{16} + 2HCl$, when saturated with anhydrous hydrochloric gas, whereas by the same treatment oil of turpentine affords the compound $C^{10}H^{16} + HCl$.

Essential oil of lemons when long kept deposits a greasy mass, from which we have obtained small crystals apparently of *Bergaptene* (p. 111).

Commerce—Essence of lemons is shipped chiefly from Messina and Palermo, packed in copper bottles called in Italian *ramiere* and by English druggists "*jars*," holding 25 to 50 kilo. or more; sometimes in tin bottles of smaller size. The quantity of essences of lemon, orange and bergamot exported from Sicily in 1871 was 368,800lb., valued at £144,520, of which about two-thirds were shipped to England.[1]

Uses—Essence of lemon is used in perfumery, and as a flavouring ingredient: and though much sold by druggists is scarcely employed in medicine.

Adulteration—Few drugs are more rarely to be found in a state of purity than essence of lemon. In fact it is stated that almost all that comes into the market is more or less diluted with oil of turpentine or with the cheaper *distilled* oil of lemons. Manufacturers of the essence complain that the demand for a cheap article forces them to this falsification of their product.

OLEUM BERGAMOTTÆ.

Oleum Bergamii; Essence or Essential Oil of Bergamot; F. *Essence de Bergamotte;* G. *Bergamottöl.*

Botanical Origin—*Citrus Bergamia* var. *vulgaris* Risso et Poiteau,[2] a small tree closely resembling in flowers and foliage the Bitter Orange. Its fruit is 2½ to 3 inches in diameter, nearly spherical, or slightly pear-shaped, frequently crowned by the persistent style; it is of a pale golden yellow

[1] Consul Dennis, *On the Commerce &c. of Sicily in* 1869, 1870, 1871. (*Reports from H.M. Consuls*, No. 4. 1873.)

[2] *Histoire naturelle des Orangers*, Paris, 1818. p. 111. tab. 53.—We accept the name given by these authors for the sake of convenience and definiteness, and not because we concur in their opinion that the Bergamot deserves to be ranked as a distinct botanical species.

mon, with the peel smooth and thin, abounding in essential oil uliar fragrance; the pulp is pale yellow, of rather acid and taste.

tree is cultivated at Reggio in Calabria, and is unknown in a te.

ory—The bergamot is one of the cultivated forms which abound enus *Citrus*, and which constitute the innumerable varieties of ge, lemon and citron. Whether it is most nearly related to the to the orange is a point discussed as early as the beginning of century. Gallesio[1] remarks that it so evidently combines the rs of the two that it should be regarded as a hybrid between The bergamot first appeared in the latter part of the 17th It is not mentioned in the grand work on orange trees of published at Rome in 1646, nor in the treatise of Commelyn[3] ior in the writings of Lanzoni (1690),[4] or La Quintinie (1692).[5] we know, it is first noticed in a little book called *Le Parfumeur*, printed at Lyons in 1693. The author who calls himself *Le irbe, parfumeur*, says that the *Essence de Cedra ou Berga-motte* is from the fruits of a lemon-tree which has been grafted on the a bergamot pear; he adds that it is got by squeezing small bits eel with the fingers in a bottle or globe large enough to allow l to enter.

amer of Nuremberg who produced a fine work on the Citron 1708, has a chapter on the *Limon Bergamotta* which he describes *limonum et fructus inter omnes nobilissimus.* He states that the prepare from it the finest essences which are sold at a high price.[6]

luction—The bergamot is cultivated at Reggio, on low ground sea, and in the adjacent villages. The trees are often inter- ith lemon and orange trees, and the soil is well irrigated and with vegetables.

essential oil (*Oleum Bergamottæ*) is obtained from the full-grown unripe and more or less green fruits, gathered in the months of er and December. It was formerly made like that of lemon by ge-process, but during the last 20 years this method has been y superseded by the introduction of a special machine for the n of the essential oil. In this machine the fruits are placed in , saucer-like, metallic dish, about 10 inches in diameter, having ntre a raised opening which with the outer edge forms a broad r channel; the dish is fitted with a cover of similar form. The rface both of the dish and cover is rendered rough by a series w, radiating metal ridges or blades which are about ¼ of an inch d resemble the backs of knives. The dish is also furnished ne small openings to allow of the outflow of essential oil; and sh and cover are arranged in a metallic cylinder, placed over a receive the oil. By a simple arrangement of cog-wheels moved ndle, the cover which is very heavy is made to revolve rapidly

du Citrus, 1811. 118.

rides, seu de malorum aureorum usu.

lantze Hesperides, Amsterd. 1676. glish translation in 1683).

gia, Ferrariæ, 1690.

[5] *Instruction pour les Jardins fruitiers . . avec un traité des Orangers*, ed. 2, 1692.

[6] *Hesperides Norimbergenses*, 1713. lib. 3. cap. 26. and p. 156 b. (We quote from the Latin edition.)

over the dish, and the fruit lying in the groove between the two is carried round, and at the same time is subjected to the action of the sharp ridges, which rupturing the oil-vessels, cause the essence to escape, and set it free to flow out by the small openings in the bottom of the dish. The fruits are placed in the machine 6, 8 or more at a time, according to their size, and subjected to the rotatory action above described for about half a minute, when the machine is stopped, they are removed and fresh ones substituted. About 7,000 fruits can be thus worked in one of these machines in a day. The yield of oil is said to be similar to that of lemon, namely $2\frac{1}{2}$ to 3 ounces from 100 fruits.

Essence of bergamot made by the machine is of a greener tint than that obtained by the old sponge-process. During some weeks after extraction it gradually deposits a quantity of white greasy matter (bergaptene), which after having been exhausted as much as possible by pressure, is finally subjected to distillation with water in order to separate the essential oil it still contains.

The fruits from which the essence has been extracted are submitted to pressure, and the juice, which is much inferior in acidity to lemon juice, is concentrated, and sold for the manufacture of citric acid. Finally, the residue from which both essence and juice have been removed, is consumed as food by oxen.

Description—[1] Essential oil of bergamot is a thin and mobile fluid of peculiar and very fragrant odour, bitterish taste, and slightly acid reaction. It has a pale greenish yellow tint, due to traces of chlorophyll as may be shown by the spectroscope. Its sp. gr. is 0·86 to 0·88; its boiling point varies from 183° to 195° C.

The oil is miscible with spirit of wine (0·83 sp. gr.), absolute alcohol, as well as with crystallizable acetic acid. Four parts dissolve clearly one part of bisulphide of carbon, but the solution becomes turbid if a larger proportion of the latter is added. Bisulphide of carbon itself is incapable of dissolving clearly any appreciable quantity of the oil. A mixture of 10 drops of the oil, 50 drops of bisulphide of carbon and one of strong sulphuric acid has an intense yellow hue. Perchloride of iron imparts to bergamot oil dissolved in alcohol a dingy brown colour.

Panuccio's oil of bergamot examined in the same way as that of lemon (p. 107) deviates 7° to the right and has therefore a dextrogyre power very inferior to that of other oils of the same class.[2] But it probably varies in this respect, for commercial specimens which we judged to be of good quality deviated from 8·8° to 10·4° to the right.

Chemical Composition—If essential oil of bergamot is submitted to rectification, the portions that successively distill over do not accord in rotatory power or in boiling point, a fact which proves it to be a mixture of several oils, as is further confirmed by analysis. It appears to consist of hydrocarbons, $C^{10}H^{16}$, and their hydrates, neither of which have as yet been satisfactorily isolated. Oil of bergamot, like that of turpentine, yields crystals of the composition $C^{10}H^{16} + 3H^2O$, if 8 parts are allowed to stand some weeks with 1 part of spirit of wine, 2 of nitric

[1] The characters are taken from some Essence of Bergamot presented to one of us (15 May 1872) as a type-sample by Messrs. G. Panuccio e figli, manufacturers of essences at Reggio and also large cultivators of the bergamot orange.

[2] See however *Oleum Neroli*, p. 113.

id (sp. gr. 1·2) and 10 of water, the mixture being frequently shaken. o solid compound is produced by saturating the oil with anhydrous ydrochloric gas.

The greasy matter that is deposited from oil of bergamot soon after its extraction,[1] and in small quantity is often noticeable in that of commerce, is called *Bergaptene* or *Bergamot Camphor*. We have obtained it in fine, white, acicular crystals, neutral and inodorous, by repeated solution in spirit of wine. Its composition according to the analysis of Mulder (1837) and of Ohme (1839) answers to the formula $C^9H^6O^3$, which in our opinion requires further investigation. Crystallized bergaptene is abundantly soluble in chloroform, ether or bisulphide of carbon; the alcoholic solution is not altered by ferric salts.

Commerce—Essence of bergamot, as it is always termed in trade, is chiefly shipped from Messina and Palermo in the same kind of bottles as are used for essence of lemon.

Uses—Much employed in perfumery, but in medicine only occasionally for the sake of imparting an agreeable odour to ointments.

Adulteration—Essence of bergamot like that of lemon is extensively and systematically adulterated, and very little is sent into the market entirely pure. It is often mixed with oil of turpentine, but a finer adulteration is to dilute it with essential oil of the leaves or with that obtained by distillation of the peel or of the residual fruits. Some has of late been adulterated with petroleum.

The optical properties as already mentioned may afford some assistance in detecting fraudulent admixtures, though as regards oil of turpentine it must be borne in mind that there are *levogyre* as well as *dextrogyre* varieties. This latter oil and likewise that of lemon is less soluble in spirit of wine than that of bergamot.

CORTEX AURANTII.

Bitter Orange Peel; F. *Ecorce ou Zestes d'Oranges amères*; G. *Pomeranzenschale.*

Botanical Origin—*Citrus vulgaris* Risso (*C. Aurantium* var. *a amara* Linn., *C. Bigaradia* Duhamel).

The Bitter or Seville or Bigarade Orange, *Bigaradier* of the French, is a small tree extensively cultivated in the warmer parts of the Mediterranean region especially in Spain, and existing under many varieties.

Northern India is the native country of the orange tree. In Gurhwal, Sikkim and Khasia there occurs a wild orange which is the supposed parent of the cultivated orange, whether Sweet or Bitter.

The Bitter Orange reproduces itself from seed and is regarded, at least by cultivators, as quite distinct from the Sweet Orange, from which however it cannot be distinguished by any important botanical characters. Generally speaking it differs from the latter in having the fruit rugged on the surface, of a more deep or reddish-orange hue, with the pulp very sour and bitter. The peel as well as the flowers and leaves are more aromatic than the corresponding parts of the Sweet Orange, and the petiole is more broadly winged.

[1] We are indebted to Mr. Robert Sanderson of Messina for placing at our disposal a quantity of this deposit for chemical examination.

History—The orange was unknown to the ancient Greeks and Romans; and its introduction to Europe is due to the Arabs who, according to Gallesio,[1] appear to have established the tree first in Eastern Africa, Arabia and Syria, whence it was gradually conveyed to Italy, Sicily and Spain. In the opinion of the writer just quoted, the bitter orange was certainly known at the commencement of the 10th century to the Arabian physicians, one of whom, Avicenna,[2] employed its juice in medicine.

There is strong evidence to show that the orange first cultivated in Europe was the *Bitter Orange* or *Bigarade*. The orange tree at Rome said to have been planted by St. Dominic about A.D. 1200 and which still exists at the monastery of St. Sabina bears a *bitter* fruit; and the ancient trees standing in the garden of the Alcazar at Seville are also of this variety. Finally, the oranges of Syria (*ab indigenis* Orenges *nuncupati*) described by Jacques de Vitri, Bishop of Acon (ob. A.D. 1214) were *acidi seu pontici saporis*.[3]

The Sweet Orange began to be cultivated about the middle of the 15th century, having been introduced from the East by the Portuguese. It has probably long existed in Southern China, and may have been taken thence to India. In the latter country there are but few districts in which its cultivation is successful, and the Bitter Orange is hardly known at all. The name it has long borne of *China*[4] or *Portugal Orange* indicates what has been the usual opinion as to its origin.

One of the first importations of oranges into England occurred in A.D. 1290, in which year a Spanish ship came to Portsmouth, of the cargo of which the queen of Edward I. bought one frail of Seville figs, one of raisins or grapes, one bale of dates, 230 pomegranates, 15 citrons and 7 *oranges* ("*poma de orenge*").[5]

Description—The Bitter Orange known in London as the *Seville Orange* is a globular fruit resembling in size, form and structure the common Sweet Orange, but having the peel much rougher and when mature of a somewhat deeper hue. The pulp of the fruit is filled with an acid bitter juice. The ripe fruit is imported into London; the peel is removed from it with a sharp knife in one long spiral strip, and quickly dried, or it is sold in the fresh state. It is the more esteemed when cut thin, so as to include as little as possible of the white inner layer.

Well-dried orange peel should be externally of a bright tint and white on its inner surface; it should have a grateful aromatic smell and bitter taste. The peel is also largely imported into London ready dried, especially from Malta. We have observed it from this latter place of three qualities, namely in elliptic pieces or quarters, in broad curled strips, and lastly a very superior kind almost wholly free from the white zest, in strips less than $\frac{1}{8}$ of an inch in width, cut apparently by a machine. Such needless subdivision as this last has undergone must greatly favour an alteration and waste of the essential oil. Foreign-dried orange peel fetches a lower price than that dried in England.

[1] *Traité du Citrus*, Paris, 1811. 222.

[2] *Opera*, ed. Valg. 1564. lib. v. sum. 1. tract. 6. p. 289.—The passage which is the following seems rather inconclusive:—". . succi acetositatis citri et succi acetositatis citranguli."

[3] Vitriaco, *Hist. orient. et occident.*, 1597. cap. 86.

[4] Hence the Dutch *Sinaasappel* or *Appelsina* and the German *Apfelsine*.

[5] *Manners and Household Expenses of England in the 13th and 15th centuries*, Lond. (Roxburghe Club) 1841. xlviij.

Microscopic Structure—There is no difference between the tissues of this drug and those of lemon peel.

Chemical Composition—The essential oil to which the peel of the orange owes its fragrant odour, is a distinct article of commerce and will be noticed hereafter under a separate head. The other constituents of the peel probably agree with those of lemon peel. The substance mentioned under the name of *Hesperidin* (p. 104) appears to be particularly abundant in unripe bitter oranges.

Uses—Bitter orange peel is much used in medicine as an aromatic tonic.

OLEUM NEROLI.

Oleum Aurantii florum; Oil or Essence of Neroli; F. *Essence de Néroli;* G. *Neroliöl.*

Botanical Origin—*Citrus vulgaris* Risso. (See page 111.)

History—Porta, the Italian philosopher of the 16th century referred to in connection with the essential oil of lemon (p. 106), was acquainted with the volatile oil of the flowers of the citron tribe ("*Oleum ex citriorum floribus*") which he obtained by the usual process of distillation, and describes as possessing the most exquisite fragrance. That distilled from orange flowers acquired a century later (1675-1685) the name of *Essence of Neroli* from Anne-Marie de la Trémoille-Noirmoutier, second wife of Flavio Orsini, duke of Bracciano and prince of Nerola or Neroli. This lady employed it for the perfuming of gloves, hence called in Italy *Guanti di Neroli.*[1] It was known in Paris to Pomet, who says[2] the perfumers have given it the name of *Neroli*, and that it is made in Rome and in Provence.

Production—Oil of Neroli is prepared from the fresh flowers of the Bigarade or Bitter Orange by the ordinary process of distillation with water, conducted in small copper stills. The water which distills over with the oil constitutes after the removal of the latter from its surface, the *Orange Flower Water* (*Aqua aurantii florum vel Aqua Naphæ*) of commerce. The manufacture is carried on chiefly in the south of France at Grasse, Cannes, and Nice.

Description and Chemical Composition—Oil of Neroli as found in commerce is seldom pure, for it generally contains an admixture of the essential oil of orange-leaf called *Essence of Petit Grain.*

By the kind assistance of Mr. F. G. Warrick of Nice, we have obtained a sample of Bigarade Neroli of guaranteed purity, to which the following observations relate. It is of a brownish hue, most fragrant odour, bitterish aromatic taste, and is neutral to test-paper. Its sp. gr. at 11° C. is 0·889. When mixed with alcohol, it displays a bright violet fluorescence, quite distinct from the blue fluorescence of a solution of quinine. In oil of Neroli the phenomenon may be shown most distinctly by pouring a little spirit of wine on to the surface of the essential oil, and causing the liquid to gently undulate. The oil is but turbidly miscible with bisulphide of carbon. It assumes a very pure, intense, and permanent crimson hue if shaken with a saturated solution

[1] *Menagio, Origini della Lingua Italiana,* 1685; *Dict. de Trévoux,* Paris, vi. (1771) 178.—The town of Nerola is about 16 miles north of Tivoli.

[2] *Histoire des Drogues,* 1694 234 ii.

of bisulphite of sodium. Examined in a column of 100 mm., we observed the oil to deviate the ray of polarized light 6° to the right.

Subjected to distillation, the larger part of the oil passes over at 185°-195° C.; we found this portion to be colourless, yet to display in a marked manner the violet fluorescence and also to retain the odour of the original oil. The portion remaining in the retort was mixed with about the same volume of alcohol (90 per cent.) and some drops of water added, yet not sufficient to occasion turbidity. A very small amount of the crystalline *Neroli Camphor* then made its appearance, floating on the surface of the liquid; by re-solution in boiling alcohol it was obtained in crystals of rather indistinct form. The re-distilled oil gave no camphor whatever.

Neroli Camphor was first noticed by Boullay in 1828. According to our observations it is a neutral, inodorous, tasteless substance, fusible at 55° C., and forming on cooling a crystalline mass. The crystallization should be effected by cooling the hot alcoholic solution, no good crystals being obtainable by slow evaporation or by sublimation. The produce was extremely small, about 60 grammes of oil having yielded not more than 0·1 gramme. Perhaps this scantiness of produce was due to the oil being a year and a half old, for according to Plisson[1] the camphor diminishes the longer the oil is kept.[2] We were unable to obtain any similar substance from the oils of bergamot, petit grain, or orange peel.

Orange Flower Water is a considerable article of manufacture among the distillers of essential oils in the south of Europe, and is imported thence for use in pharmacy. According to Boullay[3] it is frequently acid to litmus when first made,—is better if distilled in small than in large quantities, and if made from the petals *per se*, rather than from the entire flowers. He also states that only 2 ℔. of water should be drawn from 1 ℔. of flowers, or 3 ℔. if petals alone are placed in the still. As met with in commerce, orange flower water is colourless or of a faintly greenish yellow tinge, almost perfectly transparent, with a delicious odour and a bitter taste. Acidulated with nitric acid, it acquires a pinkish hue more or less intense, which disappears on saturation by an alkali.

Uses—Oil of Neroli is consumed almost exclusively in perfumery. Orange flower water is frequently used in medicine to give a pleasant odour to mixtures and lotions.

Adulteration—The large variation in value of oil of Neroli as shown by price-currents[4] indicates a great diversity of quality. Besides being very commonly mixed, as already stated, with the distilled oil of the leaves (*Essence de Petit Grain*),[5] it is sometimes reduced by addition of the less fragrant oil obtained from the flowers of the Portugal or Sweet Orange. In some of these adulterations we must conclude that orange flower water participates: metallic contamination of the latter is not unknown.

[1] *Journ. de Pharm.* xv. (1829) 152.

[2] Yet we extracted it from an old sample labelled "*Essence de Néroli Portugal — Méro.*"

[3] *Bulletin de Pharm.* i. (1809) 337-341.

[4] Thus in the price-list of a firm at Grasse, Neroli is quoted as of *four* qualities, the lowest or "commercial" being less than half the price of the finest.

[5] We have been informed on good authority that the Neroli commonly sold contains ⅔ of Essence of Petit Grain, and ⅓ of Essence of Bergamot, the remaining ⅓ being true Neroli.

Other Products of the genus Citrus.

Essence or Essential Oil of Petit Grain—was originally obtained by subjecting little immature oranges to distillation (Pomet—592); but it is now produced, and to a large extent, by distillation of the leaves and shoots either of the Bigarade or Bitter Orange, or of the Portugal or Sweet Orange. The essence of the former is by far the more fragrant and commands double the price.

The leaves are obtained in the lemon-growing districts of the Mediterranean where the essence is manufactured. Lemon-trees being mostly grafted on orange-stocks, the latter during the summer put forth shoots, which are allowed to grow till they are often some feet in length. The cultivator then cuts them off, binds them in bundles, and conveys them to the distiller of *Petit Grain*. The strongest shoots are frequently reserved for walking-sticks. The leaves of the two sorts of orange are easily distinguished by their smell when crushed. Essence of Petit Grain which in odour has a certain resemblance to Neroli, is used in perfumery and especially in the manufacture of Eau de Cologne.

According to Gladstone (1864) it consists mainly of a hydrocarbon probably identical with that from oil of Neroli.

Essential Oil of Orange Peel—is largely made at Messina and also in the south of France. It is extracted by the sponge-, or by the *écuelle*-process, and partly from the Bigarade and partly from the Sweet or Portugal Orange, the scarcely ripe fruit being in either case employed. The oil made from the former is much more valuable than that obtained from the latter, and the two are distinguished in price-currents as *Essence de Bigarade* and *Essence de Portugal*.

These essences are but little consumed in England, but are largely used in Germany. They are employed in liqueur-making and in perfumery. For what is known of their chemical nature, the reader can consult the works named at foot.[1]

Essence of Cedrat—The true Citron or Cedrat tree is *Citrus medica* Risso, and is of interest as being the only member of the Orange tribe the fruit of which was known in ancient Rome. The tree itself which appears to have been cultivated in Palestine in the time of Josephus, was introduced into Italy in about the 3rd century. In A.D. 1003 it was much grown at Salerno near Naples, whence its fruits were sent as presents to the Norman princes.[2]

At the present day, the citron appears to be nowhere cultivated extensively, the more prolific lemon tree having generally taken its place. It is however scattered along the Western Riviera, and is also grown on a small scale about Pizzo and Paola on the western coast of Calabria, in Sicily, Corsica and the Azores. Its fruits which often weigh several pounds, are chiefly sold for being candied. For this purpose the peel, which is excessively thick, is salted and in that state shipped to England and Holland. The fruit has a very scanty pulp.[3]

[1] Gmelin, *Chemistry*, xiv. (1860) 305. 306; Gladstone, *Journ. of Chem. Soc.* xvii. (1864); Wright (and Piesse) in *Yearbook of Pharmacy*, 1871. 546; 1873. 518; *Journ. of Chem. Soc.* xi. (1873) 552, &c.

[2] Gallesio, *Traité du Citrus*, 1811. 222.

[3] Oribasius who lived in the second half of the 4th century and who was physician and friend of the emperor Julian the Apostate, accurately describes the citron as a fruit consisting of three parts, namely a central acid pulp, a thick and fleshy zest and an aromatic outer coat.—*Medicinalia collecta*, lib. i. c. 64.

Essence of Cedrat which is quoted in some price-lists maj prepared from the scarcely ripe fruit by the sponge-process; but as more profitable to export the fruit salted, it is very rarely manufactu and that which bears its name is for the most part fictitious.

FRUCTUS BELÆ.

Bela; Bael Fruit, Indian Bael, Bengal Quince.

Botanical Origin—*Ægle Marmelos*[1] Correa (*Cratæva Marmelos* a tree found in most parts of the Indian peninsula, where it is o planted in the neighbourhood of temples, being esteemed sacred by Hindus. It is truly wild in the forests of the Coromandel Ghâts of the Western Himalaya.

It attains a height of 30–40 feet, is usually armed with strong sl thorns and has trifid leaves, the central leaflet being petiolate and la than the lateral. The fruit is a large berry, 2 to 4 inches in diam variable in shape, being spherical or somewhat flattened like an ora ovoid, or pyriform,[2] having a smooth hard shell; the interior div into 10–15 cells each containing several woolly seeds, consists (mucilaginous pulp, which becomes very hard in drying. In the f state the fruit is very aromatic, and the juicy pulp which it contains an agreeable flavour, so that when mixed with water and sweetene forms a palatable refrigerant drink. The fruit is never eaten as des though its pulp is sometimes made into a preserve with sugar.

The fruit of the wild tree is described as small, hard, and flavour The bark of the stem and root, the flowers and the expressed juic the leaves are used in medicine by the natives of India.

History—The tree under the name of *Bilva*[3] is constantly allu to as an emblem of increase and fertility in ancient Sanskrit po some of which as the Yajur Veda are supposed to have been written later than 1000 B.C.

Garçia d'Orta who resided in India as physician to the Portug viceroy at Goa in the 16th century, wrote an account of the fruit u the name of *Marmelos de Benguala* (Bengal Quince) *Çirifole* or *l* describing its use in dysentery.

In the following century it was noticed by Bontius, in whose writ edited by Piso[5] there is a bad figure of the tree as *Malum Cydonium.* was also figured by Rheede[6] and subsequently under the design of *Bilack* or *Bilack tellor* by Rumphius.[7] The latter states that indigenous to Gujarat, the eastern parts of Java, Sumbawa and Cel and that it has been introduced into Amboina.

But although *Ægle Marmelos* has thus long been known appreciated in India, the use of its fruit as a medicine attracte

[1] *Ægle*, one of the Hesperides.—*Marmelos* from the Portuguese *marmelo*, a quince.

[2] In the Botanical Garden of Buitenzorg in Java, three varieties are grown, namely—*fructibus oblongis*, *fructibus subglobosis*, and *macrocarpa*.

[3] We are indebted to Professor Monier Williams of Oxford for pointing out to us many references to *Bilva* in the Sa writings.

[4] *Sirî-phal* and *Bel* are Hindustani n

[5] *De Indiæ re nat. et med.* 1658, l c. 8.

[6] *Hort. Malab.* iii. (1682) ta (*Covalam*).

[7] *Herb. Amb.* i. tab. 81.

tention in Europe till about the year 1850. The dried fruit which as a place in the *British Pharmacopœia* is now not unfrequently nported.

Description—We have already described the form and structure of he fruit, which for medicinal use should be dried when in a half ripe tate. It is found in commerce in dried slices having on the outer side a smooth greyish shell enclosing a hard, orange or red, gummy pulp in which are some of the 10 to 15 cells existing in the entire fruit. Each cell includes 6 to 10 compressed oblong seeds nearly 3 lines in length, covered with whitish woolly hairs. When broken the pulp is seen to be nearly colourless internally, the outside alone having assumed an orange tint. The dried pulp has a mucilaginous, slightly acid taste, without aroma, astringency or sweetness.

There is also imported Bael fruit which has been collected when ripe, as shown by the well-formed seeds. Such fruits arrive broken irregularly and dried, or sawn into transverse slices and then dried, or lastly entire, in which case they retain some of their original fragrance resembling that of elemi.

Microscopic Structure—The rind of the fruit is covered with a strong cuticle and further shows two layers, the one exhibiting not very numerous oil-cells, and the other and inner made up of sclerenchyme. The tissue of the pulp, which treated with water swells into an elastic mass, consists of large cells with considerable cavities between them. The seeds when moistened yield an abundance of mucilage nearly in the same way as White Mustard or Linseed. In the epidermis of the seeds certain groups of cells are excessively lengthened and thus constitute the curious woolly hairs already noticed. They likewise afford mucilage in the same way as the seed itself.

Chemical Composition—We are unable to confirm the remarkable analyses of the drug alluded to in the *Pharmacopœia of India*;[1] nor can we explain by any chemical examination upon what constituent the alleged medicinal efficacy of bael depends.

The pulp moistened with cold water yields a red liquid containing chiefly mucilage, and (probably) pectin which separates if the liquid is concentrated by evaporation. The mucilage may be precipitated by neutral acetate of lead or by alcohol, but is not coloured by iodine. It may be separated by a filter into a portion truly soluble (as proved by the addition of alcohol or acetate of lead) and another, comprehending the larger bulk, which is only swollen like tragacanth, but is far more glutinous and completely transparent.

Neither a per- nor a proto-salt of iron shows the infusion to contain ny appreciable quantity of tannin,[2] nor is the drug in any sense possessed f astringent properties.

Uses—Bael is held in high repute in India as a remedy for ysentery and diarrhœa; at the same time it is said to act as a laxative here constipation exists.

Adulteration—The fruit of *Feronia Elephantum* Correa, which has

[1] Edition 1868, pp. 46 and 441.

[2] We are thus at variance with Collas Pondichery, who attributes to the ripe fruit 5 *per cent. of tannin.*—*Hist. nat. etc. du Bel ou Vilva* in *Revue Coloniale*, xvi (1856) 220-238.

a considerable external resemblance to that of *Ægle Marmelos* and is called by Europeans *Wood Apple*, is sometimes supplied in India for bael. It may be easily distinguished: it is *one-celled* with a large five-lobed cavity (instead of 10 to 15 cells) filled with numerous seeds. The tree has pinnate leaves with 2 or 3 pairs of leaflets. We have seen *Pomegranate Peel* offered as *Indian Bael.*[1]

SIMARUBEÆ.

LIGNUM QUASSIÆ.

Quassia, Quassia Wood, Bitter Wood; F. *Bois de Quassia de la Jamaique, Bois amer;* G. *Jamaica Quassiaholz.*

Botanical Origin—*Picræna excelsa* Lindl. (*Quassia excelsa* Swartz, *Simaruba excelsa* D C., *Picrasma excelsa* Planchon), a tree 50 to 60 feet in height, somewhat resembling an ash and having inconspicuous greenish flowers and black shining drupes the size of a pea. It is common on the plains and lower mountains of Jamaica and is also found in the islands of Antigua and St. Vincent. It is called in the West Indies *Bitter Wood* or *Bitter Ash.*

History—Quassia wood was introduced into Europe about the middle of the last century. It was derived from *Quassia amara* L., a shrub or small tree with handsome crimson flowers, belonging to the same order, native of Panama, Venezuela, Guiana and Northern Brazil. It was subsequently found that the *Bitter Wood* of Jamaica which Swartz and other botanists referred to the same genus, possessed similar properties, and as it was obtainable of much larger size, it has since the end of the last century been generally preferred. The wood of *Q amara* called *Surinam Quassia*, is however still used in France and Germany.[2]

The first to give a good account of Jamaica quassia was John Lindsay,[3] a medical practitioner of the island, who writing in 1791 described the tree as long known not only for its excellent timber, but also as a useful medicine in putrid fevers and fluxes. He adds that the *bark* is exported to England in considerable quantity—"for the purposes of the brewers of ale and porter."

Quassia, defined as the wood, bark, and root of *Q. amara* L., was introduced into the London Pharmacopœia of 1788; in the edition of 1809, it was superseded by the wood of *Picræna excelsa.* In the stock-book of a London druggist (J. Gurney Bevan, of Plough Court, Lombard Street) we find it first noticed in 1781 (as *rasuræ*), when it was reckoned as having cost 4*s.* 2*d.* per lb.

Description—The quassia wood of commerce consists of pieces of the stem and larger branches, some feet in length and often as thick as a man's thigh. It is covered with bark externally of a dusky grey or blackish hue, white and fibrous within, which it is customary to strip off and reject. The wood which is of a very light yellowish tint is tough

[1] 40 bags in a drug sale, 8th May 1873.

[2] The *Pharmacopœia Germanica* of 1872 expressly forbids the use of the wood of *Picræna* in place of *Quassia.*

[3] *Trans. Roy. Soc. Edinburgh*, iii. (1794) 205. tab. 6.

d strong, but splits easily. In transverse section it exibits numerous e close medullary rays, which intersect the rather obscure and egular rings resembling those of annual growth of our indigenous ody stems. The centre is occupied by a cylinder of pith of minute e. In a longitudinal section whether tangential or radial, the wood pears transversely striated by reason of the small vertical height of the edullary rays.

The wood often exhibits certain blackish markings due to the ycelium of a fungus; they have sometimes the aspect of delicate itterns and at others appear as large dark patches.

Quassia has a strong, pure bitter taste, but is devoid of odour. It is ways supplied to the retail druggist in the form of turnings or raspings, e former being obtained in the manufacture of the *Bitter Cups*, now ften seen in the shops.

Microscopic Structure—The wood consists for the most part of longated pointed cells (libriform), traversed by medullary rays, each of he latter being built up of about 15 vertical layers of cells. The single ayers contain from one to three rows of cells. The ligneous rays thus nclosed by medullary parenchyme, are intersected by groups of tissue onstituting the above-mentioned irregular rings. On a longitudinal ection this parenchyme exhibits numerous crystals of oxalate of calcium nd sometimes deposits of yellow resin. The latter is more abundant in the large vessels of the wood. Oxalate and resin are the only solid matters perceptible in the tissues of this drug.

Chemical Composition—The bitter taste of quassia is due to *Quassiin*, which was first obtained by Winckler in 1835 and analysed by Wiggers[1] who assigned it the formula $C^{10}H^{12}O^3$, now regarded as doubtful. According to the latter, quassiin is an irresolvable, neutral substance, crystallizable from dilute alcohol or from chloroform. It requires for solution about 200 parts of water, but is not soluble in ether; it forms an insoluble compound with tannic acid. Quassia wood is said to yield about $\frac{1}{10}$ per cent. of quassiin. A watery infusion of quassia, especially if a little caustic lime has been added to the drug, displays a slight fluorescence, due apparently to quassiin. Quassia wood dried at 100° C. yielded us 7·8 per cent of ash.

Commerce—The quantity of Bitter Wood shipped from Jamaica in 1871 was 56 tons.[2]

Uses—The drug is employed as a stomachic and tonic. It is poisonous to flies and is not without narcotic properties in respect to the higher animals.

Substitutes—The wood of *Quassia amara* L., the *Bitter Wood of Surinam*, bears a close resemblance, both external and structural, to the drug just noticed; but its stems never exceed 4 inches in diameter and are commonly still thinner. Their thin, brittle bark is of a greyish yellow and separates easily from the wood. The latter is somewhat denser than the quassia of Jamaica, from which it may be distinguished by its medullary rays being composed of a single or less frequently of a double row of cells, whereas in the wood of *Picræna excelsa*, they consist of two or three rows, less frequently of only one.

[1] Liebig's *Annalen d. Pharm.* xxi. (1837) 40. [2] *Blue Book*, Island of Jamaica, for 1871.

Surinam Quassia Wood is exported from the Dutch colony of Surinam. The quantity shipped thence during the nine months ending 30 Sept. 1872, was 264,675 lb.[1]

The bark of *Samadera indica* Gärtn., a tree of the same natural order owes its bitterness to a principle,[2] which agrees perhaps with quassiin.

BURSERACEÆ.

OLIBANUM.

Gummi-resina Olibanum, Thus masculum;[3] *Olibanum, Frankincense;* F. *Encens;* G. *Weihrauch.*

Botanical Origin—Olibanum is obtained from the stem of several species of *Boswellia,* inhabiting the hot and arid regions of Eastern Africa near Cape Gardafui and of the southern coast of Arabia. Notwithstanding the recent elaborate and valuable researches of Birdwood[4] the olibanum trees are still but imperfectly known, as will be evident in the following enumeration :—

1. *Boswellia Carterii* Birdw.—This includes the three following forms, which may be varieties of a single species, or may belong to two or more species,—a point impossible to settle until more perfect materials shall have been obtained.

a. *Boswellia* No. 5, Oliver, *Flora of Tropical Africa,* I. (1868) 324, *Mohr Madow* of the natives.—Somali Country, growing a little inland in the valleys and on the lower parts of the hills, never on the range close to the sea. It yields the olibanum called *Lubân Belowi* or *Lubân Sheheri* (Playfair).

b. *Boswellia* No. 6, Oliver, *op. cit.,* Birdwood, *Linn. Trans.* xxvii. tab. 29.—Sent by Playfair among the specimens of the preceding and with the same indications and native name.

c. *Maghrayt d'shechaz* of the Maharas, Birdwood, l. c. tab. 30. *B. thurifera* (?), Carter, *Journ. of Bombay Branch of R. Asiat. Soc.* ii. tab. 23; *B. sacra* Flückiger, *Lehrbuch der Pharmakognosie des Pflanzenreiches,* 1867. 31. Ras Fartak, S. E. coast of Arabia, growing in the detritus of limestone cliffs and close to the shore, also near the village of Merbat (Carter, 1844–1846).

2. *B. Bhau-Dajiana* Birdw. l. c. tab. 31.—Somali Country (Playfair); growing in Victoria Gardens, Bombay, where it flowered in 1868.

[1] *Consular Reports* No. 3, presented to Parliament, July 1873.

[2] Rost van Tonningen, *Jahresbericht* of Wiggers (Canstatt) for 1858. 75; *Pharm. Journ.* ii. (1872) 644. 654.

[3] The λίβανος of the Greeks, the Latin *Olibanum,* as well as the Arabic *Lubân,* and the analogous sounds in other languages, are all derived from the Hebrew *Lebonah* signifying *milk:* and modern travellers who have seen the frankincense trees state that the fresh juice is *milky,* and hardens when exposed to the air. The word *Thus* on the other hand seems to be derived from the verb θύειν, *to sacrifice.*

[4] *On the Genus* Boswellia, *with descriptions and figures of three new species.—Linn. Trans.* xxvii. (1871) 111.—The materials on which Dr. Birdwood's observations have been chiefly founded, and to which we also have had access, are,—1. Specimens collected during an expedition to the Somali Coast made by Col. Playfair in 1862.—2. Growing plants at Bombay and Aden, raised from cuttings sent by Playfair.—3. A specimen obtained by H. J. Carter in 1846 near Ras Fartak on the south-east coast of Arabia and still growing in Victoria Gardens, Bombay; and figured by Carter in *Journ. of Bombay Branch of R. Asiatic Soc.,* ii. (1848) 380, tab. 23.

swellia No. 4, Oliver, *op. cit.*—Bunder Murayah, Somali Country). Grows out of the rock, but sometimes in the detritus of e; never found on the hills close to the sea, but further inland he highest ground. Yields *Lubân Bedowi* and *L. Sheheri;* was at Kew as *Mohr add,* a name applied by Birdwood also to *-Dajiana.*

ldition to the foregoing, from which indubitably the olibanum nerce is collected, it may be convenient to mention also the :—

ipyrifera Richard (*Plösslea floribunda* Endl.), a tree of Sennaar ssinia affords a resin like olibanum, which is not collected.

urifera Colebr. (*B. glabra* et *B. serrata* Roxb.), the *Salai* tree of oduces a soft odoriferous resin which is used in the country e but is not the olibanum of commerce.

rereana Birdw. l. c. tab. 32, a well-marked and very distinct native of the Somali Country, where it grows out of the smooth e rocks of the hills a few miles from the coast. The tree, which res call *Yegaar,* abounds in a highly fragrant resin collected and *Lubân Meyeti,* or *Lubân Matti,* which we regard to be the sub-iginally known as *Elemi.*

ory—The use of olibanum goes back to a period of extreme , as proved by the numerous references in the Mosaic writings ible to *incense,* of which it was an essential ingredient. It is r well known that many centuries before Christ, the drug was e most important objects of the traffic which the Phœnicians[1] ptians carried on with Arabia.

ssor Dumichen[2] of Strassburg has discovered at the temple of Bâhri in Upper Egypt, paintings illustrating the traffic carried on Egypt and Arabia as early as the 17th century B.C. In these s there are representations not only of bags of olibanum, but libanum trees planted in tubs or boxes, being conveyed by ship bia to Egypt. Inscriptions on the same building, deciphered ssor D., describe with the utmost admiration the shipments of woods, heaps of incense, verdant incense-trees,[3] ivory, gold, es, besides other productions not yet identified.

tailed account of frankincense is given by Theophrastus[4] (B.C. who relates that the commodity is produced in the country of eans, one of the most active trading nations of antiquity, g the southern shores of Arabia. It appears from Diodorus Sabæans sold their frankincense to the Arabs, through whose passed to the Phœnicians who disseminated the use of it in the throughout their possessions, as well as among the nations with ey traded. The route of the caravans from south-eastern Arabia

, *Das phönizische Alterthum,* iii. 299.

hen (Joannes), *The fleet of an queen from the 17th century before and ancient Egyptian military presented on a monument of the . . . after a copy taken from the he temple of Dêr-el-Baheri,* trans- the German by Anna Dumichen, 65.

[3] In one of the inscriptions they are referred to in terms which Professor D. has thus rendered:—Thirty-one verdant incense-trees brought among the precious things from the land of Arabia, for the majesty of this god Amon, the lord of the terrestrial thrones. Never has anything similar been seen since the foundation of the world.

Hist. Plant. lib. iv. c. 7.

to Gaza in Palestine, has recently (1866) been pointed out by Professor Sprenger. Plutarch relates that when Alexander the Great captured Gaza, 500 talents of olibanum and 100 talents of myrrh were taken, and sent thence to Macedonia.

The *libanophorous region* of the old Sabæans is in fact the very country visited by Carter in 1844 and 1846, and lying as he states on the south coast of Arabia between long. 52° 47′ and 52° 23′ east. It was also known to the ancients,—at least to Strabo and Arrian, that the opposite African coast likewise produced olibanum, as it does extensively to the present day; and the latter states that the drug is shipped partly to Egypt and partly to Barbaricon at the mouth of the Indus.

As exemplifying the great esteem in which frankincense was held by the ancients, the memorable gifts presented by the Magi to the infant Saviour will occur to every mind. A few other instances may be mentioned: Herodotus[1] relates that the Arabians paid to Darius, king of Persia, an annual tribute of 1,000 talents of frankincense.

A remarkable Greek inscription brought to light in modern times[2] on the ruins of the temple of Apollo at Miletus, records the gifts made to the shrine by Seleucus II., king of Syria (B.C. 246–227), and his brother Antiochus Hierax, king of Cilicia, which included in addition to vessels of gold and siver, ten talents of frankincense (λιβανωτὸς) and one of myrrh.

The emperor Constantine made numerous offerings to the church under St. Silvester, bishop of Rome, A.D. 314–335, of costly vessels and fragrant drugs and spices,[3] among which mention is made in several instances of *Aromata* and *Aromata in incensum*, terms under which olibanum is to be understood.[4]

With regard to the consumption of olibanum in other countries, it is an interesting fact that the Arabs in their intercourse with the Chinese, which is known to have existed as early as the 10th century, carried with them *olibanum*, myrrh, dragon's blood, and liquid storax,[5] drugs which are still imported from the west into China. The first-named is called *Ju-siang* i.e. *milk-perfume*, a curious allusion to its Arabic name *Lubân* signifying *milk*. In the year 1872, Shanghai imported[6] of this drug no less than 1,360 peculs (181,333 ℔).

Collection—Cruttenden,[7] who visited the Somali Country in 1843, thus describes the collecting of olibanum by the Mijjertheyn tribe, whose chief port is Bunder Murayah (lat. 11° 43′ N.):—

"During the hot season the men and boys are daily employed in collecting gums, which process is carried on as follows:—About the end of February or beginning of March, the Bedouins visit all the trees in succession and make a deep incision in each, peeling off a narrow strip of bark for about five inches below the wound. This is left for a month, when a fresh incision is made in the same place, but deeper. A third

[1] Rawlinson's *Herodotus*, ii. (1858) 488.

[2] Chishull, *Antiquitates Asiaticæ*, Lond. 1728 65–72.

[3] These remarkable gifts are enumerated by Vignoli in his *Liber Pontificalis*, Rome, 1724–55, and include beside Olibanum, *Oleum nardinum*, *Oleum Cyprium*, *Balsam*, *Storax Isaurica*, *Stacte*, *Aromata cassiæ*, *Saffron* and *Pepper*.

[4] The ancient name of Cape Gardafui was *Promontorium Aromatum*.

[5] Bretschneider, *Ancient Chinese*, &c. Lond. 1871. 19.

[6] *Returns of Trade at the Treaty Ports in China for* 1872, p. 4.

[7] *Trans. Bombay Geograph. Soc.* vii. (1846) 121.

nth elapses and the operation is again repeated, after which the gum supposed to have attained a proper degree of consistency. The untain-rides are immediately covered with parties of men and boys, o scrape off the large clear globules into a basket, whilst the inferior ality that has run down the tree is packed separately. The gum en first taken from the tree is very soft, but hardens quickly. . . . . ery fortnight the mountains are visited in this manner, the trees procing larger quantities as the season advances, until the middle of ptember, when the first shower of rain puts a close to the gathering at year."

Carter,[1] describing the collection of the drug in southern Arabia, rites thus :—" The gum is procured by making longitudinal incisions rough the bark in the months of May and December, when the cuticle istens with intumescence from the distended state of the parts beneath: e operation is simple, and requires no skill on the part of the operator. n its first appearance the gum comes forth white as milk, and according its degree of fluidity, finds its way to the ground, or concretes on the anch near the place from which it first issued, from whence it is colcted by men and boys, employed to look after the trees by the different milies who possess the land in which they grow." According to Capin Miles,[2] the drug is not collected by the people of the country, but y Somalis who cross in numbers from the opposite coast, paying the rab tribes for the privilege. The Arabian *Lubân*, he says, is considered ferior to the African.

Description—Olibanum as found in commerce varies rather conderably in quality and appearance. It may in general terms be scribed as a dry gum-resin, consisting of detached tears up to an inch a length, of globular, pear-shaped, clavate, or stalactitic form, mixed rith more or less irregular lumps of the same size. Some of the ager tears are slightly agglutinated, but most are distinct. The preominant forms are rounded,—angular fragments being less frequent, hough the tears are not seldom fissured. Small pieces of the transcent brown papery bark are often found adhering to the flat pieces.

The colour of the drug is pale yellowish or brownish, but the finer ralities consist of tears which are nearly colourless or have a greenish e. The smallest grains only are transparent, the rest are transcent and somewhat milky, and not transparent even after the removal f the white dust with which they are always covered. But if heated about 94° C., they become almost transparent. When broken they thibit a rather dull and waxy surface. Examined under the polarizing icroscope no trace of crystallization is observable.

Olibanum softens in the mouth; its taste is terebinthinous and ightly bitter, but by no means disagreeable. Its odour is pleasantly omatic, but is only fully developed when the gum-resin is exposed to elevated temperature. At 100° C. the latter softens without actually sing, and if the heat be further raised decomposition begins.

Chemical Composition—Cold water quickly changes olibanum to a soft whitish pulp, which when rubbed down in a mortar forms an sulsion. Immersed in spirit of wine, a tear of olibanum is not altered

[1] *Loc. cit.*

[2] *On the neighbourhood of Bunder-Maryah*, in *Journ. of R. Geograph. Society*, xlii. (1872) 65.

much in form, but it becomes of an almost pure opaque white. In the first case the water dissolves the gum, while in the second the alcohol removes the resin. We find that pure olibanum treated with spirit of wine leaves 27 to 35 per cent. of gum, the solution of which is precipitated by perchloride of iron as well as by silicate of sodium, but not by neutral acetate of lead. It is consequently a gum of the same class as gum arabic, if not identical with it. Its solution contains the same amount of lime as gum arabic affords.

The resin of olibanum has been examined by Hlasiwetz (1867), according to whom it is a uniform substance having the composition $C^{40}H^{30}O^{6}$. We find that it is not soluble in alkalis, nor have we succeeded in converting it into a crystalline body by the action of dilute alcohol. It is not uniformly distributed throughout the tears; if they are broken after having been acted upon by dilute alcohol, it now and then happens that a clear stratification is perceptible, showing a concentric arrangement.

Olibanum contains an essential oil, of which Braconnot (1808) obtained 5 per cent., Stenhouse (1840) 4 per cent., and Kurbatow (1871) 7 per cent. According to Stenhouse it has a sp. gr. of 0·866, a boiling point of 179·4° C., and an odour resembling that of turpentine but more agreeable. Kurbatow separated this oil into two portions, the one of which has the formula $C^{10}H^{16}$, boils at 158° C., and combines with HCl to form Artificial Camphor; the other contains oxygen.

Olibanum submitted to destructive distillation affords no umbelliferone. Heated with strong nitric acid it develops no peculiar colour, but at length camphresinic acid, $C^{20}H^{14}O^{7}$, is formed, which may be also obtained from many resins and essential oils if submitted to the same oxidizing agent.

Commerce—The olibanum of Arabia is shipped from several small places along the coast between Damkote and Al Kammar, but the quantity produced in this district is much below that furnished by the Somali Country in Eastern Africa. The latter is brought to Zeyla, Berbera, Bunder Murayah, and many smaller ports, whence it is shipped to Aden or direct to Bombay. The trade is chiefly in the hands of Banians, and the great emporium for the drug is Bombay. A certain portion is shipped through the straits of Bab-el-Mandeb to Jidda,—Von Kremer[1] says to the value of £12,000 annually. The quantity exported from Bombay in the year 1872–73 was 25,100 cwt., of which 17,446 cwt. were shipped to the United Kingdom, and 6,184 cwt. to China.[2]

Uses—As a medicine olibanum is nearly obsolete, at least in Britain. The great consumption of the drug is for the incense used in the Roman Catholic and Greek Churches.

MYRRHA.

Gummi-resina Myrrha; Myrrh; F. *Myrrhe;* G. *Myrrha.*

Botanical Origin—Ehrenberg who visited Egypt, Nubia, Abyssinia, and Arabia in the years 1820–26, brought home with him specimens of

[1] *Aegypten, Forschungen über Land und Volk*, Leipzig, 1863.

[2] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1872–73, pt. ii. 78.

rees found at Ghizan (Gison), a town on the strip of coast-
d Tihâma, opposite the islands of Farsan Kebir and Farsan
a little to the north of Lohaia, on the eastern side of the Red
so on the neighbouring mountains of Djara (or Shahra) and
re the myrrh trees form the underwood of the forests of
inga and *Euphorbia*. Nees von Esenbeck who examined these
drew up from them a description of what he called *Balsamo-*
rrha, which he figured in 1828.[1]
hrenberg's herbarium had been incorporated in the Royal
of Berlin some years ago, Berg examined these specimens,
o the conclusion that they consist of *two species*, namely that
nd figured by Nees, and a second to which was attached
e must hope) two memoranda bearing the following words :—
hæ arbor ad Gison,—Martio," and "*Ex huic simillima arbore*
se Myrrham effluentem legi.[2] *Hæc specimina lecta sunt in*
jara et Kara Februario." This plant Berg named *B. Ehren-*
Oliver in his *Flora of Tropical Africa* (1868)[4] is disposed
Berg's plant the same as *B. Opobalsamum* Kth., a tree or
ing myrrh, found by Schweinfurth on the Bisharrin mountains
a not far from the coast between Suakin and Edineb. But
th himself does not admit the identity of the two plants.[5]
ı however that the myrrh of commerce is chiefly of African

be confessed that the botany of the myrrh trees is still en-
with uncertainty, which will not be removed until the very
which the drug is collected shall have been well explored
tent observer.

y—Myrrh has been used from the earliest times together with
s a constituent of incense,[6] perfumes and unguents. It was
nt of the holy oil used in the Jewish ceremonial as laid
oses; and it was also one of the numerous components of the
Kyphi of the Egyptians, a preparation used in fumigations,
ıd the process of embalming, and of which there were several

previous article we have pointed out (p. 122) several early
to myrrh in connection with olibanum, in which it is
that the myrrh (when weights are mentioned) is always in
quantity. Of the use of the drug in mediæval Europe there
ices, but they tend to show that the commodity was rare and
Thus myrrh is recommended in the Anglo-Saxon Leech-
e used with frankincense in the superstitious medical practice
ı century.
Wardrobe accounts of Edward I. there is an entry under date
1299, for gold, frankincense and *myrrh*, offered by the king

Medicinales, Dusseldorf, ii.
5.
ng in 1872 to Prof. Ehrenberg
were possible that we could *see*
imen, we received the answer
not be found.
Schmidt, *Darstellung u. Be-*
. offizin. Gewächse, iv. (1863)
tab. xxix. *d.*; also *Bot. Zeitung*, 16 Mai,
1862. 155.
[4] Vol. i. 326.
[5] Petermann, *Geogr. Mittheilungen*, 1868.
127.
[6] Cantic. iii. 6.
[7] Cockayne, *Leechdoms &c. of Early*
England, ii. (1865) 295, 297.

in his chapel on that day, it being the Feast of Epiphany.[1] Myrrh again figures in the accounts of Geoffroi de Fleuri[2] master of the wardrobe (*argentier*) to Philippe le Long, king of France, where record is made of the purchase of—"4 onces d'estorat calmite et *mierre* (myrrh) . . . . encenz et laudanon,"—for the funeral of John, posthumous son of Louis X., A.D. 1316.

Gold, silver, silk, precious stones, pearls, camphor, musk, *myrrh* and spices are enumerated[3] as the presents which the Khan of Cathay sent to Pope Benedict XII. at Avignon about the year 1342. The myrrh destined for this circuitous route to Europe[4] was doubtless that of the Arabian traders, with whom the Chinese had constant intercourse during the middle ages. Myrrh in fact is still somewhat largely consumed in China.[5]

The name *Myrrh* is from the Hebrew and Arabic *Mur*, whence also the Greek σμύρνα. The ancient Egyptian *Bola* or *Bal*, and the Sanskrit *Vola* are preserved in the Persian and Indian words *Bol*, *Bola* and *Heera-bol*, well-known names for myrrh.

Stacte (στακτή), a substance often mentioned by the ancients, is said by Pliny to be a spontaneous liquid exudation of the myrrh tree, more valuable than myrrh itself. The author of the Periplus of the Erythrean Sea represents it as exported from Muza in Arabia[6] together with myrrh. Theophrastus[7] speaks of myrrh as of two kinds, solid and liquid. No drug of modern times has been identified with the *stacte* or *liquid myrrh* of the ancients: that it was a substance obtainable in quantity seems evident from the fact that 150 pounds of it, said to be the offering of an Egyptian city, were presented to St. Silvester at Rome, A.D. 314–335.[8]

The myrrh of the ancients was not obtained exclusively from Arabia. The author of the Periplus[9] who wrote about A.D. 64, records it to have been an export of Abalites, Malao, and Mosyllon (the last named, the modern Berbera), ancient ports of the African coast outside the straits of Bab-el-Mandeb; and he even mentions that it is conveyed by small vessels to the opposite shores of Arabia.

Secretion—Marchand[10] who examined a branch of three years' growth of what he terms *B. Myrrha*, represents the gum-resin as chiefly deposited in the cortical layers, with a little in the medulla.

Collection—From the information given by Ehrenberg to Nees von Esenbeck,[11] it appears that myrrh when it first exudes is of an oily and then of a buttery appearance, yellowish white, gradually assuming a golden tint and becoming reddish as it hardens. It exudes from the

[1] *Liber quotidianus Contrarotulatoris Garderobæ . . . . Edwardi I.*, Lond. 1787. pp. xxxii. and 27.—The custom is still observed by the sovereigns of England, and the Queen's oblation of gold, frankincense and myrrh is still annually presented on the Feast of Epiphany in the Chapel Royal in London.

[2] Doüet d'Arcq, *Comptes de l'Argenterie des rois de France*, 1851. 19.

[3] Yule, *Cathay and the way thither*, ii. 357.

[4] For the costly presents in question *never reached their destination*, having been all plundered by the way!

[5] Shanghai imported in 1872, 18,600lb. of Myrrh.—*Reports of Trade at the Treaty Ports in China for* 1872, p. 4.

[6] Vincent, *Commerce of the Ancients*, ii. (1807) 316.—Muza or Moosa is supposed to be identical with a place still bearing that name lying about 20 miles east of Mokha.

[7] Lib. ix. c. 4.

[8] Vignolius, *Liber Pontificalis*, i. (1724) 95.

[9] Vincent, *op. cit.* ii. 127. 129. 135.

[10] Baillon, *Adansonia*, vii. (1866–7) 261. pl. 8.

[11] Op. cit.

rk like cherry-tree gum and becomes dark and of inferior value by e. Although Ehrenberg says that the myrrh he saw was of fine ality, he does not mention it being gathered by the natives.

With regard to the localities[1] in which the drug is collected, uttenden[2] who visited the Somali coast in 1843, says that myrrh is ought from the Wadi Nogâl, south-west of Cape Gardafui, and from urreyhan, Ogahden and Agahora; and that some few trees are found the mountains behind Bunder Murayah. Major Harris[3] saw the yrrh tree in the Adel desert and in the jungle of the Háwash, on the ay from Tajúra to Shoa.

Vaughan[4] states that the Somali Country and the neighbourhood of urrur (or Harar or Adari, 9° 20′ N., 42° 17′ E.) south-west of Zeila are e chief producing districts. It is generally brought to the great fair Berbera held in November, December, and January, where it is rchased by the Banians of India and shipped for Bombay.

Myrrh trees abound on the hills about Shugra and Sureea in the rritory of the Fadhli or Fudthli tribe, lying to the eastward of Aden; yrrh is collected from them by Somalis who cross from the opposite ast for the purpose and pay a tribute for the privilege.[5] But a sample this drug received by one of us from Vaughan in 1852, and others we ve since seen in London (and easily recognized) prove it to be somehat different from typical myrrh, and it is probably afforded by other species than that yielding African myrrh.

Description—Myrrh consists of irregular roundish masses, varying size from small grains up to pieces as large as an egg, and occasionally uch larger. They are of an opaque reddish brown with dusty dull rface. When broken they exhibit a rough or waxy fracture, having a oist and unctuous appearance especially when pressed, and a rich own hue. The fractured, translucent surface often displays characristic whitish marks which the ancients compared to the light mark the base of the finger-nails. Myrrh has a peculiar and agreeable agrance with an aromatic, bitter, and acrid taste. It cannot be finely owdered until deprived by drying of some of its essential oil and water; or when heated does it melt like colophony.

Water disintegrates myrrh forming a light brown emulsion, which iewed under the microscope appears made up of colourless drops, among hich are granules of yellow resin. Alcohol dissolves the resin of myrrh aving angular non-crystalline particles of gum and fragments of bark.

Chemical Composition—The gum which is dissolved when myrrh treated with water amounts to between 40 and 50 per cent., or may ven reach 67 per cent.[6] It is partially precipitable by neutral acetate lead, showing that it differs from gum arabic; but a portion (about a ourth) agrees with the latter in respect to action on acetate of lead.

The resin dissolves completely in chloroform or alcohol, and the olour of the latter solution is but slightly darkened by perchloride of

[1] See my paper with map in *Ocean Highways*, April 1873, also *Pharm. Journ.* 19 pril, 1873. 821.—D. H.

[2] *Trans. Bombay Geogr. Soc.* vii. (1846) 2.

[3] *Highlands of Æthiopia* (1844) i. 426.

[4] *Pharm. Journ.* xii. (1853) 226.

[5] Capt. S. B. Miles, in *Journ. of R. Geograph. Soc.* xli. (1871) 236.

[6] Druggists who prepare large quantities of Tincture of Myrrh may utilize this gum for making a common sort of mucilage. *Pharm. Journ.* 10 June, 1871. 1001.

iron. It is but partially soluble in alkalis or in bisulphide of carbon. Brückner (1867) found this portion to yield 75·6 per cent. of carbon and 9·5 of hydrogen. The resin which the bisulphide refuses to dissolve, is freely soluble in ether. It contains only 57·4 per cent. of carbon. The resin of myrrh to which when moistened with alcohol a small quantity of hydrochloric acid is added, assumes a violet hue, but far less brilliant than that displayed by resin of galbanum when treated in a similar manner.

Myrrh yields on distillation a volatile oil which in operating on 25 lb. of the drug, we obtained to the extent of ¾ per cent.[1] It is a yellowish, rather viscid liquid, neutral to litmus, having a powerful odour of myrrh and sp. gr. 0·988 at 13° C.[2] In a column 50 mm. long, it deviates a ray of light 30·1° to the left. By submitting it to distillation, we obtained before the oil boiled, a few drops of a strongly acid liquid having the smell of formic acid. Neutralized with ammonia, this liquid produced in solution of mercurous nitrate a whitish precipitate which speedily darkened, thus indicating formic acid, which is developed in the oil. Old myrrh is in fact said to yield an acid distillate. The oil begins to boil at about 266° C., and chiefly distills over between 270° and 290°.

On combustion in the usual way it afforded carbon 84·70, hydrogen 9·98. Having been again rectified in a current of dry carbonic acid, it had a boiling point of 262–263° C., and now afforded[3] carbon 84·78, hydrogen 10·26, which would nearly answer to the formula $C^{22}H^{30}O$. The results of Ruickholdt's analysis (1845) of essential oil of myrrh assign it the formula $C^{10}H^{14}O$, which is the same as that of carvol and thymol, and widely different from that indicated by our experiments.

The oil which we rectified displays a faintly greenish hue; it is miscible in every proportion with bisulphide of carbon, the solution exhibiting at first no peculiar coloration when a drop of nitric or sulphuric acid is added. Yet the mixture to which nitric acid (1·20) has been added, assumes after an hour or two a fine violet hue which is very persistent, enduring even if the liquid is allowed to dry up in a large capsule. If to the crude oil dissolved in bisulphide of carbon bromine be added, a violet hue is produced; and if the solution is allowed to evaporate, and the residue diluted with spirit of wine, it assumes a fine blue which disappears on addition of an alkali. The oil is not altered by boiling with alcoholic potash, nor does it combine with alkaline bisulphites.

Commerce—The drug is shipped to Europe chiefly by way of Bombay. The imports into that port in the year 1872–73 amounted to 494 cwt., the exports to 546 cwt.; of the latter quantity 493 cwt. were shipped to the United Kingdom.[4]

Uses—Myrrh though much used does not appear to possess any very important medicinal powers, and is chiefly employed on account of its bitter, aromatic properties.

Other varieties of Myrrh—Though the myrrh of commerce exhibits some diversity of appearance, the drug-brokers and druggists of

[1] Ruickholdt got 2·18 per cent.; Bley and Diesel (1845) from 1·6 to 3·4 per cent. of an acid oil.

[2] Gladstone (1863) found the oil a little *heavier* than water.

[3] Analyses performed in my laboratory by Dr. Buri, February 1874.—F. A. F.

[4] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1872-73, pt. ii. 34. 78.

are not in the habit of applying any special designations to the t qualities. There are however two varieties which deserve

Bissa Bôl (*Bhesabol, Bysabole*), *Hebbakhade* of the Somalis, *Myrrha* of Martiny,[1] formerly called *East India Myrrh.*

drug is of African origin, but of the plant which yields it, is known. Vaughan[2] who sent a sample from Aden to one of 852, was told by the natives that the tree from which it is d resembles that affording *Heera Bôl* or true myrrh, but that it is eless distinct. The drug is exported from the whole Somali Mokha, Jidda, Aden, Makulla, the Persian Gulf, India and even Bombay official returns show that the quantity imported in the year 1872–73, was 224 cwt., all shipped from Aden.

a Bôl differs from myrrh chiefly *in odour*, which when once is easily recognizable; in other respects it agrees with true fine specimens have all the outward characters of real myrrh, haps are passed off for it. The Bissa Bôl usually seen is r an impure and foul substance, which is regarded by London ts as well as by the Banian traders in India as a very inferior rt of myrrh. Vaughan states that it is mixed with the food milch cows and buffaloes in order to increase the quantity and the quality of their milk, and that it is also used as size to a bright gloss to whitewashed walls.

Arabian Myrrh—This is the drug we have mentioned at p. 127 as d to the eastward of Aden; and it is of interest as substantiating ement of Theophrastus that both olibanum and myrrh grow in n Arabia.

drug, which is not distinguished by any special name in English s in irregular masses seldom exceeding 1½ inches long, and a somewhat gummy-looking exterior. The larger lumps seem by the cohesion of small, rounded, translucent, externally tears or drops. The fracture is like that of common myrrh but the whitish markings. The odour and taste are those of the drug. Pieces of a semi-transparent papery bark are attached of the lumps. Finally the drug is distinguished by being more more brittle, and less unctuous than common myrrh.

ELEMI.

Resina Elemi; Elemi; F. *Résine Elémi;* G. *Elemiharz.*

anical Origin—The resin known in pharmacy as *Elemi* is from a tree growing in the Philippines, which Blanco,[5] a botanist ila, described in 1845 under the name of *Icica Abilo*, but which

[1] *Hop. d. med.-pharm. Nat. u. Heilk.*, ii. (1854) 98, 101.

[2] *Journ.* xii. (1853) 227.

[3] 65, 10 packages of this drug con- out 15 cwt. were consigned to me London by a friend in China, who based the drug under the notion as true myrrh. The commodity was bad of its kind, and was sold with difficulty at 30s. per cwt.—D. H.

[4] Thus 100 grains powdered and then exhausted with spirit of wine left 75 grains of gummy residue, whereas in a parallel experiment with fine myrrh of the usual sort, the same quantity left a residue of 53 grains.

[5] *Flora de Filipinas*, segunda impresion, Manila, 1845. 256.

is completely unknown to the botanists of Europe. Blanco's description is such that, if correct, the plant cannot be placed in either of the old genera *Icica* or *Elaphrium*, comprehended by Bentham and Hooker in that of *Bursera*, nor yet in the allied genus *Canarium*; in fact even the order to which it belongs is somewhat doubtful.[1]

The tree grows in the province of Batangas in the island of Luzon (south of Manila), where its name in the Tagala language is *ábilo*; the Spaniards call it *Arbol a brea*, i.e. *pitch-tree*, from the circumstance that its resin is used for the caulking of boats.

History—The explicit statements of Theophrastus in the 3rd century B.C. relative to olibanum have already been mentioned. The same writer narrates[2] that a little above Coptus on the Red Sea, no tree is found except the acacia (ἀκάνθη) of the desert . . . but that on the sea there grow laurel (δάφνη) and olive (ἐλαία), from the latter of which exudes a substance much valued to make a medicine for the stanching of blood.

This story appears again in Pliny[3] who says that in Arabia the olive tree exudes tears which are an ingredient of the medicine called by the Greeks *Enhæmon*, from its efficacy in healing wounds.

Dioscorides[4] briefly notices the *Gum of the Ethiopian olive*, which he likens to scammony; and the same substance is named by Scribonius Largus[5] who practised medicine at Rome during the 1st century.

The writers who have commented on Dioscorides have generally adopted the opinion that the exudation of the so-called olive-tree of Arabia and Ethiopia was none other than the substance known to them as *Elemi*, though as remarked by Mattioli,[6] the oriental drug thus called by no means well accords with the description left by that author.

As to that name, the earliest mention of it appears in the middle of the 15th century. Thus in a list of drugs sold at Frankfort about 1450, we find *Gommi Elempnij*.[7] Saladinus[8] who lived about this period, enumerates *Gumi Elemi* among the drugs kept by the Italian apothecaries, but we have not met with the name in any other writer of the school of Salerno. The *Arbolayre*,[9] a herbal supposed to have been printed about 1485, gives some account of *Gomme Elempni*, stating that it is the gum of the lemon tree and not of fennel as some think,—

[1] On consulting Mr. A. W. Bennett who is now studying the *Burseraceæ* of India, as to the probable affinities of Blanco's plant, we received from him the following remarks. "I have little hesitation in pronouncing that from the description, *Icica Abilo* cannot be a *Canarium*, but what it is, is more difficult to say. The leaves having the lowest pair of leaflets smallest, seems at first sight very characteristic of *Canarium*; but the following considerations tend the other way. 1. The *opposite* leaves which occur nowhere in *Burseraceæ* except in *Amyris*, with which the plant does not agree in many ways.—2. The *stipellæ* which are not found anywhere in the order.—3. The *quinate* flowers. In all species of *Canarium* the parts of the flower are in threes, including *C. commune* which according to Miquel extends to the Philippines. The only exception is *C.* (*Scutinanthe* Thwaites) *brunneum*, with which it does not agree in other respects.

"The foregoing reasons almost equally exclude *Icica* (*Bursera*); yet the fruit of Blanco's plant seems so eminently that of a *Burseracea*, that I think it must belong to that order, but with some error in the description of the leaves."

[2] *Hist. Plant.* lib. iv. c. 7.

[3] Lib. xii. c. 38.

[4] Lib. i. c. 141.

[5] *Compositiones Medicament.* cap. 103.

[6] *Comm. in lib. i. Dioscoridis.*

[7] Flückiger, *Die Frankfurter Liste*, Halle, 1873. 7. 16.

[8] *Compendium Aromatariorum*, Bonon, 1488.

[9] This very rare volume is one of the treasures of the National Library of Paris.

at it resembles Male Incense,—and makes an excellent ointment r wounds.

The name *Enharmon* [1] of Pliny, also written *Enhæmi*, is probably the riginal form of the word *Animi*, another designation for the same rug, though also applied as at the present day to a sort of copal. It even possible that the word *Elemi* has the same origin.[2]

This primitive Elemi is in our opinion identical with a peculiar sort f olibanum known as *Luban Meyeti*, afforded by *Boswellia Frereana* Birdwood (p. 121). It has a remarkable resemblance both in external ppearance and in odour to the substances in after-times imported from America, and which were likened to the elemi and animi of the Old World.

The first reference to these drugs as productions of America comes rom the pen of Monardes [3] who has a chapter on *Animi and Copal.* He describes animi as of a more oily nature than copal, of a very greeable odour, and in grains resembling olibanum but of larger size, nd adds that it differs from the animi of the Old World in being less hite and clear.

At a somewhat later period this resin and some similar substances egan to be substituted for *Elemi* which had become scarce.[4] Pomet [5] ho as a dealer in drugs was a man of practical knowledge, laments hat this American drug was being sold by some as Elemi, and by others s Animi or as Tacamaca. It was however introduced in great plenty, nd at length took the place of the original elemi which became ompletely forgotten.

American Elemi was in turn discarded in favour of another sort imported from the Philippines. The first mention of this substance is to be found among the descriptions accompanied by drawings sent by Father Camelli to Petiver of London, of the shrubs and trees of Luzon [6] in the year 1701. Camelli states that the tree, which from his drawing preserved in the British Museum appears to us to be a species of *Canarium*, is very tall and large, that it is called by the Spaniards *Arbol de la brea*, and that it yields an abundance of odorous resin which is commonly used for pitching boats. Living specimens of the tree together with samples of the resin were brought to Paris from Manila by the traveller Perrottet about the year 1820. For the last twenty years the resin has been common, and is now imported in large quantities [7] for use in the arts, so displacing all other kinds. It has been adopted as the *Elemi* of the *British Pharmacopœia* (1867), and is in fact the only variety of elemi now found in English commerce.

Description—Manila elemi is a soft, resinous substance, of granular consistence not unlike old honey, and when recent and quite pure is colourless; more often it is found contaminated with carbonaceous matter which renders it grey or blackish, and it is besides mixed with

[1] From the Greek ἐναιμον, signifying *blood-stopping*.

[2] Brassavola observes—"quandoque inclinavimus ut gummi oleæ Æthiopicæ esset gummi *elemi* dicti, quasi *enharmi*."—*Examen simplicium*, Lugd. 1537. 386.

[3] *Libro de las cosas que se traen de nuestras Indias Occidentales*, Sevilla, 1565.

[4] Thus Piso in 1658 describes the resin of an *Icica* as exactly resembling *Elemi* and quite as good for wounds.—*Hist. nat. et méd. Ind. Occ.* 122.

[5] *Histoire des Drogues*, 1694, 261.

[6] Ray, *Hist. Plant.* iii. (1704), appendix, p. 67. No. 13.—Compare also p. 60. No. 10.

[7] Thus in a drug-sale, May 8, 1877, there were offered 275 cases,—equal to about 480 cwt.

chips and similar impurities. By exposure to the air it becomes harder and acquires a yellow tint. It has a strong and pleasant odour suggestive of fennel and lemon, yet withal somewhat terebinthinous. When moistened with spirit of wine, it disintegrates, and examined under the microscope is seen to consist of acicular crystals which may be easily separated to the extent of 20 per cent. At the heat of boiling water it softens, and at a somewhat higher temperature fuses into a clear resin.

Chemical Composition—Manila elemi is rich in essential oil. On submitting 28 lb. of it to distillation with water, we obtained 2 lb. 13 oz. (equivalent to 10 per cent.) of a fragrant, colourless, neutral oil, of sp. gr. 0·861 at 15° C. Observed in Wild's polaristrobometer we found it to be strongly dextrogyre.[1] H. Ste Claire Deville[2] on the other hand has examined an oil of elemi that was strongly levogyre. This discrepancy shows that there are among the oils of various kinds of elemi, differences similar to those existing in the oils of turpentine and copaiba. By the action of dry hydrochloric acid gas, Deville obtained from his oil of elemi a solid crystalline substance, $C^{10}H^{16} + 2\ HCl$. We failed to produce any such compound from the oil of Manila elemi. The oil of elemi dissolves in bisulphide of carbon; when mixed with concentrated sulphuric acid, it becomes thick and assumes a deep orange colour.

By submitting the crude oil to fractional distillation, we separated it into six portions, of which the first five were dextrogyre in gradually diminishing degree, while the sixth displayed a weak deviation to the left.[3] The first portion having been dissolved in four times its weight of strong sulphuric acid, washed and again distilled, exhibited a deviation to the left.[4]

Maujean[5] a French pharmacien, examined Manila elemi as long ago as 1821 and proved it to contain two resins, the one soluble in cold, the other only in hot spirit of wine. Bonastre[6] a little later made a more complete analysis, showing that the less soluble resin which he obtained to the extent of 25 per cent. is easily crystallizable, and apparently identical with a substance obtainable in a similar manner from what he regarded as true elemi, which the Manila resin was not then held to be. Dumas analysed this crystalline resin of Manila elemi and found it to contain 85·3 per cent. of carbon and 11·7 per cent. of hydrogen.[7] Baup (1851)

[1] I observed the following deviations :—

In a column of 25 millimetres from 47°·5 to 70°·5 (deviation 23°).
" " 50 " " 93°·6 (" 46°·1).
" " 100 " " 49°·6 (2·1 + 90 = 92°·1).—F.A.F

[2] *Comptes Rendus*, xii. (1841) 184.

[3] The following deviations were observed, in a column of 25 millimetres :—

1.	Oil distilled at	172°—180° C.	from	47°·6 to 74°·5 ;	deviation	26°·9	to the *right*.
2.	"	180°—183°	"	71°·2	"	23°·6	"
3.	"	183°—184°·5	"	68°·8	"	21°·2	"
4.	"	184°—195°	"	65°·8	"	18°·2	"
5.	"	200°—230°	"	61°·0	"	13°·4	"
6.	Thickish yellow residue		"	46°·2	"	1°·4	to the *left*.

[4] From 47°·6 to 46°.

[5] *Journ. de Pharm.* ix. (1823) 45. 47.

[6] Id. x. (1824) 199.

[7] The formula $C^{40}H^{66}O$, assigned to the crystallized resin of elemi by the analyses of Rose, of Hess and of Johnston, requires 85·4 carbon and 11·7 of hydrogen. These chemists found from 84 to 84·45 per cent. carbon,—results perhaps explicable by the suggestion that the crystallized resin still retained a little of the amorphous resin, which according to Johnston and Rose is less rich in carbon.

rve it the name of *Amyrin*. According to our experiments, it is readily olated to the extent of 20 per cent. when Manila elemi is treated ith cold spirit of wine, in which the crystals of amyrin are but slightly luble. If the elemi is pure, the amyrin may be thus obtained (by ashing with spirit and pressure between bibulous paper) in a cake of owy whiteness, which may be further purified by crystallization from iling alcohol. The fusing point of the crystals is 171° C.; by repeated ystallizations, it rises as high as 176°.

It is remarkable that other sorts of elemi (see p. 134) such as those of exico, Brazil and Mauritius, though afforded by very different trees, t closely accord in chemical properties with the Manila drug. All onsist of a crystalline and a non-crystalline resin, the former separating s a white magma when the crude resin is treated with cold spirit of wine, and both being perfectly neutral.

By allowing an alcoholic solution of the amorphous resin of Manila elemi[1] to evaporate, Baup obtained in very small quantity crystals of *Bréine*, a substance fusing at 187° C., which he considered to be distinct from amyrin.

He likewise extracted from Manila elemi a crystallizable substance soluble in water to which he gave the name of *Bryoidin*,[2] and in smaller quantity a second also soluble in water which he called *Bréidine*. From the experiments of Baup it appears that bryoidin is soluble in 360 parts of water at 10° C., and melts at 135° C.; whereas bréidine requires for solution 260 parts of water and fuses at a temperature not much over 100° C.

We have also obtained *Bryoidin* by operating in the following manner: the watery liquid left in the still after the distillation of 28 lb. of Manila elemi was poured off from the mass of hard resin, and having been duly concentrated, it deposited together with a dark extractiform matter, colourless acicular crystals of bryoidin. The deposit in question having been drained and allowed to dry, the bryoidin may be separated by boiling water or by cold ether. We found the latter the more convenient; it readily takes up the bryoidin contaminated only with a little resin. The ethereal solution should be allowed to evaporate and the residual crystalline mass boiled in water, when the solution (which is colourless), poured off from the resin, will deposit upon cooling brilliant tufts of acicular crystals of bryoidin. The boiling in water requires to be several times repeated before the whole of the bryoidin can be removed; the latter sometimes crystallizes as a mossy arborescent growth. Bryoidin is a neutral substance, of bitter taste, scarcely soluble in cold water but dissolving easily in boiling water, or in alcohol or ether. When a little is placed in a watch-glass, covered with a plate of glass, and then gently heated over a lamp, it sublimes in delicate needles. To obtain it perfectly pure, it is best to sublime it in a current of dry carbonic acid. Thus purified its fusing point is 133·5 C.; after fusion it concretes as a transparent, amorphous mass, which if immersed in glycerin and raised to the temperature of 135° C., suddenly crystallizes.

[1] I am indebted for a specimen of the material that Baup worked upon and which is called *Resa of Arbol a brea*, to M. Roux, pharmacien of Nyon.—F. A. F.

[2] From the Greek βρύον, in allusion to the moss-like aspect sometimes assumed by the crystals.

We have observed that if the filtered mother-liquor of bryoidin after complete cooling and standing for a day or two is warmed, it becomes turbid and that in a few minutes there separate from it long white flocks like bits of paper or wool, which do not disappear either by warming or by cooling the liquid; under the microscope they are seen to consist partly of thread-like, partly of acicular crystals. It is possible this substance is Baup's *Bréidine;* we found it to fuse at 135° C., to be neutral, and to crystallize from weak alcohol exactly like bryoidin. Both it and bryoidin look very voluminous in water, but are so small in weight that we have not yet obtained either in quantity sufficient for analysis.

Uses—Elemi is scarcely used in British medicine except in the form of an ointment, sometimes prescribed as a stimulating application to old wounds.

Other sorts of Elemi—1. ***Mexican Elemi, Vera Cruz Elemi***—This drug which used to be imported into London about thirty years ago, but which has now disappeared from commerce, is the produce of a tree named by Royle *Amyris elemifera* growing at Oaxaca in Mexico.[1] It is a light yellow, or whitish, brittle resin occurring in semi-cylindrical scraped pieces, or in irregular fragments which are sometimes translucent but more often dull and opaque. It easily softens in the mouth so that it may be masticated, and has an agreeable terebinthinous odour. Treated with cold spirit of wine (·838), it breaks down into a white magma of acicular crystals (*Amyrin ?*).

2. ***Brazilian Elemi***—Was described as long ago as 1658 by the traveller Piso, as a substance completely resembling the elemi of the Old World and applicable to the same purposes. It is the produce of several trees described as species of *Icica,* as *I. Icicariba* DC., *I. heterophylla* DC., *I. heptaphylla* Aubl., *I. Guianensis* Aubl., *I. altissima* Aubl.—In New Granada a similar exudation[2] is furnished by *I. Caranna* H.B.K.

A specimen in our possession from Pernambuco[3] is a translucent, greenish-yellow, fragrant, terebinthinous resin, which by cold spirit of wine may be separated into two portions, the one soluble, the other a mass of colourless acicular crystals. The resin spontaneously exuded and collected from the trunks, is often opaque and white, grey, or yellowish, looking not unlike fragments of old mortar. The microscope shows it to be made up of minute acicular crystals.[4]

3. ***Mauritius Elemi***—Fine specimens of this substance and of *Colophonia Mauritiana* DC. the tree affording it, were sent to one of us (H.) in 1855 by Mr. Emile Fleurot of Mauritius. The resin accords in its general characters with Manila elemi, like which it leaves after treatment with cold spirit of wine, an abundance of crystals resembling amyrin.

[1] Royle's very imperfect specimens of this plant are in the British Museum.

[2] G. Planchon, *Bulletin de la Soc. Bot. de France*, xv. (1868) 16.

[3] Given me by Mr. Manley late of Pernambuco. I have also an authentic specimen of the resin of *I. heterophylla* DC. collected at Santarem, Pará, by Mr. H. W. Bates in 1853.—D. H.

[4] For some experiments on the resin of *Icica*, see Gmelin, *Chemistry*, xvi. (1866) 421.

ban Meyeti[1] or *Luban Matti*.—This substance which we claim *Oriental* or *African Elemi* of the older writers, and also one of s anciently designated *Animi*[2] is the exudation of *Boswellia* Birdwood, a remarkable tree gregarious on the bare limestone r Bunder Murayah to the west of Cape Gardafui. The tree called *Yegaar* by the natives, is of small stature, and differs other species of *Boswellia* growing on the same coast in having glaucous leaves with obtuse leaflets, crisped at the margin. is smooth, papery, and translucent, and easily stripped off in ts which are used for writing on. Though growing wild, the said by Capt. Miles[3] to be carefully watched and even some-pagated. The resin exudes after incision in great plenty, soon and is collected by the Somali tribes who dispose of it to or shipment to Jidda and ports of Yemen: occasionally a reaches London among the shipments of olibanum. It is used st for chewing like mastich.

n *Meyeti* occurs in the form of detached droppy tears and s, occasionally in stalactitic masses, 1 to 3 ounces in weight. s very easily with a brilliant conchoidal fracture, showing an substance of a pale amber yellow and perfectly transparent. ly it is more or less coated with a thin opaque white crust, en under the microscope appears non-crystalline. Many of the e pieces of the thin, brown, papery bark adhering to them. s has an agreeable odour of lemon and turpentine, and a mild inous taste.

ed with spirit of wine (·838) a large proportion of it is dissolved; solved portion is not crystalline. Subjected to distillation with e obtained from 20 lb., 10 ounces of a volatile oil (= 3·1 per ving a fragrant odour suggestive of elemi and sp. gr. 0·856 at The oil examined in a column 50 millim. long, deviates the ray e left. By fractional distillation we found it to consist of a re hydrocarbon, $C^{10}H^{16}$, mixed with an oxygenated oil which not succeed in isolating; the latter is evidently levogyre, and proportion more than sufficient to overcome the weak re power of the hydrocarbon.

is no gum in this exudation; it is therefore essentially from olibanum, the product of closely allied species of

MELIACEÆ.

CORTEX MARGOSÆ.

Cortex Azadirachtæ; Nim Bark, Margosa Bark.

nical Origin—*Melia indica* Brandis (*M. Azadirachta* L., *Aza-indica* Juss.), an ornamental tree, 40 to 50 feet high and attain-

is the general Arabic name for *meyeti* perhaps from Jebel Meyet, of 1200 feet on the Somali Coast 10′.

sistance of Professor G. Planchon, we have ascertained that it is identically the same substance as described by Guibourt under the name *Tacamaque jaune huileux, A.—Hist. des Drogues*, iii. (1850) 453.

[3] *Journ. Geograph. Soc.* xlii. (1872) 61.

ing a considerable girth, well known throughout India by its Hindustani name of *Nim*, or by its Portuguese appellation of *Margosa*.[1] It is much planted in avenues, but occurs wild in the forests of Southern India, Ceylon and the Malay Archipelago.

The hard and heavy wood which is so bitter that no insect will attack it, the medicinal leaves and bark, the fruit which affords an acrid bitter oil used in medicine and for burning, the gum which exudes from the stem, and finally a sort of toddy obtained from young trees, cause the *Nim* to be regarded as one of the most useful trees of India.

M. indica is often confounded with *M. Azedarach* L., a native of China[2] and probably of India, now widely distributed throughout the warmer regions of the globe, and not rare even in the south of Europe. The former has an oval fruit (by abortion) one-celled and one-seeded, and leaves simply pinnate. The latter has the fruit five-celled, and leaves bi-pinnate.

History—The tree under the Sanskrit name of *Nimba* is mentioned in the *Ayurvedas* (*Systema Medicinæ*) of Susruta, one of the most ancient of the Hindu medical writings.

In common with many other productions of India, it attracted the notice of Garçia d'Orta, physician to the Portuguese viceroy at Goa, and he published an account of it in his work on drugs in 1563.[3] Christoval Acosta[4] in 1578 supplied some further details and also a figure of the tree. The tonic properties of the bark, long recognized by the native physicians of India, were successfully tested by Dr. D. White of Bombay in the beginning of the present century, and have since been generally admitted.[5] The drug has a place in the *Pharmacopœia of India*.

Description—The bark in our possession[6] is in coarse fibrous pieces about $\frac{1}{8}$ of an inch thick and 2 to 3 inches wide, slightly channelled. The suberous coat is rough and cracked, and of a greyish rusty hue. The inner surface is of a bright buff and has a highly foliaceous structure. On making a transverse section three distinct layers may be observed:—firstly the suberous coat exhibiting a brown parenchyme interwoven with small bands of corky tissue,—secondly a dark cellular layer, and then the foliaceous liber. The dry bark is inodorous and has a slightly astringent bitter taste.

Microscopic Structure—The suberous coat consists of numerous layers of ordinary cork-cells, which cover a layer of nearly cubic sclerenchymatous cells. This latter however is not always met with, secondary bands of cork (*rhytidoma*) frequently taking its place. The liber is commonly built up of strong fibre-bundles traversed by narrow medullary rays, and transversely separated by bands of parenchymatous liber tissue. Crystals of oxalate of calcium occur in the parenchyme more frequently than the small globular starch grains. The structure of the bark varies considerably according to the gradual development of the secondary cork-bands.

[1] From *amargoso*, bitter.

[2] It is mentioned in Chinese writings dating long prior to the Christian era.—Bretschneider, *Chinese Botanical Works*, 1870. 12.

[3] *Colloquios dos Simples, &c.*, Goa, 1563.

[4] *Tractado de las Drogas y Medicinas de las Indias Orientales*, Burgos, 1578, cap. 43.

[5] Waring, in *Pharmacopœia of India*, 1868. 443.

[6] We are indebted for it to Mr. Broughton of Ootacamund.

Chemical Composition—Margosa bark was chemically examined India by Cornish[1] (1856), who announced it as the source of a bitter kaloid to which he gave the name of *Margosine*, but which he obtained ly in minute quantity as a "*double salt of Margosine and Soda*," in ng white needles.

From the bitter oil of the seeds he isolated a substance which he lled *Margosic Acid*, and which he doubted to be capable of affording rystallizable salts. The composition neither of this acid nor of margoine is known, nor have the properties of either been investigated.

The small sample of the bark at our disposal only enables us to add hat an infusion produced with perchloride of iron a blackish precipitate, nd that the infusion is not altered by tannic acid or iodohydrargyrate of potassium. If the inner layers of the bark are alone exhausted with water, the liquid affords an abundant precipitate with tannic acid; but if the *entire* bark is boiled in water, the tannic matter which it contains will form an insoluble compound with the bitter principle and prevent the latter being dissolved. It is thus evident that to isolate the bitter matter of the bark, it would be advisable to work on the liber or inner layers alone, which might readily be done, as they separate easily.

According to the recent researches of Broughton[2] the bitter principle is an amorphous resin soluble in the usual solvents and in boiling solutions of fixed alkalies. From the latter it is precipitated by acids, yet, probably, altered. Broughton ascribes the formula $C^{26}H^{50}O^{11}$ to this bitter resin purified by means of bisulphide of carbon, ether and absolute alcohol; it fused at 92° C. He obtained moreover a small quantity of a crystallized principle, which he believed to be a fatty body, yet its melting point of 175° C. is not in favour of this suggestion.

Uses—In India the bark is used as a tonic and antiperiodic, both by natives and Europeans. Dr. Pulney Andy of Madras has found the leaves beneficial in small-pox.

CORTEX SOYMIDÆ.

Cortex Swietenæ; Rohun Bark

Botanical Origin—*Soymida*[3] *febrifuga* Juss. (*Swietenia febrifuga* Willd.), a tree of considerable size not uncommon in the forests of Central and Southern India. The timber called by Europeans *Bastard Cedar* is very durable and strong, and much valued for building purposes.

History—The introduction of Rohun Bark into the medical practice of Europeans is due to Roxburgh[4] who recommended the drug as a substitute for Cinchona, after numerous trials made in India about the year 1791. At the same time he sent supplies to Edinburgh, where Duncan made it the subject of a thesis[5] which probably led to it being introduced into the materia medica of the Edinburgh Pharmacopœia of 1803, and of the Dublin Pharmacopœia of 1807.

[1] *Indian Annals of Medical Science*, Calcutta, iv. (1857) 104.

[2] *Madras Monthly Journ. of Med. Science*, quoted in *Pharm. Journ.* June 14, 1873, 992.

[3] From *Sómida*, the Telugu name of the tree; *Róhun* is its name in Hindustani.

[4] *Medical Facts and Observations*, Lond. vi. (1795) 127.

[5] *Tentamen inaugurale de Swietenia Soymida*, Edinb. 1794.

Though thus officially recognized, it does not appear that the bark came much into use or by any means fulfilled the expectations raised in its favour. At present it is regarded simply as a useful astringent tonic, and as such it has a place in the *Pharmacopœia of India* (1868).

Description—Our specimen of Rohun bark [1] which is from a young tree, is in straight or somewhat curved, half-tubular quills, an inch or more in diameter and about $\frac{1}{8}$ of an inch in thickness. Externally it is of a rusty grey or brown, with a smoothish surface exhibiting no considerable furrows or cracks, but numerous small corky warts. These form little elliptic scars or rings, brown in the centre, and but slightly raised from the surface. The inner side and edges of the quills are of a bright reddish brown.

A transverse section exhibits a thin outer layer coloured by chlorophyll, and a middle layer of a bright rusty hue, traversed by large medullary rays and darker wedge-shaped rays of liber. The latter has a fibrous fracture, that of the outer part of the bark being rather corky or foliaceous. The whole bark when comminuted is of a rusty colour, becoming reddish by exposure to air and moisture. It has a bitter astringent taste with no distinctive odour. The older bark is very thick and fibrous, and according to Broughton, "as red as the reddest Cinchona."

Microscopic Structure—The bark presents but few structural peculiarities. The ring of liber is made up of alternating prosenchymatous and parenchymatous tissue. In the latter the larger cells are filled with mucilage, the others with starch. The prosenchymatous groups of the liber exhibit that peculiar form we have already described as *hornbast* (p. 70); it chiefly contains the tannic matter, besides stellate crystals of oxalate of calcium which are distributed through the whole tissue of the bark. The medullary rays are of the usual form, and contain starch granules. The corky coat is built up of a small number of vaulted cells.

Chemical Composition [2]—The bitter principle of the bark has been ascertained by Broughton [3] to be a nearly colourless resinous substance, sparingly soluble in water but more so in alcohol, ether, or benzol. It does not appear to unite with acids or bases, and is less soluble in water containing them than in pure water. It has a very bitter taste, and refuses to crystallize either from benzol or ether. It contains no nitrogen. To this we may add that the bark is rich in tannic acid.

Uses—Rohun bark is administered in India as an astringent tonic and antiperiodic, and is reported useful in intermittent fevers and general debility, as well as in the advanced stages of dysentery and in diarrhœa.

[1] Kindly sent us by Mr. Broughton of Ootacamund.

[2] The analysis alluded to in the *Pharm. of India* (p. 444) concerns *Khaya* (*Swietenia*) *senegalensis* and not the present species, as my friend Dr. Overbeck has informed me.—F. A. F.

[3] Beddome, *Flora Sylvatica*, Madras, part i. (1869) 8,—also information communicated direct.

RHAMNACEÆ.

FRUCTUS RHAMNI.

Bacca Rhamni, Baccæ Spinæ cervinæ; Buckthorn Berries; F. *Baies de Nerprun;* G. *Kreuzdornbeeren.*

Botanical Origin—*Rhamnus cathartica* L., a robust diœcious shrub with spreading branches, the smaller of which often terminate in a stout thorn. It is indigenous to the greater part of Europe, and stretches eastward into Siberia. In England the buckthorn though generally distributed is abundant only in certain districts; in Scotland it occurs wild in but a single locality. Yet in Norway, Sweden, and Finland it grows much further north.

The fruit which ripens in the autumn is collected for use chiefly in the counties of Hertfordshire, Buckinghamshire and Oxfordshire.

History—The buckthorn was well known to the Anglo-Saxons and is mentioned as *Hartsthorn* or *Waythorn* in their medical writings and glossaries dating before the Norman conquest. As *Spina Cervina* it is referred to by Pietro Crescentio of Bologna[1] about A.D. 1305.

The medicinal use of the berries was familiar to all the writers on botany and materia medica of the 16th century.

Description—The fruits, which are only used in the fresh state, are small, juicy, spherical drupes the size of a pea, black and shining, bearing on the summit the remnants of the style, and supported below by a slender stalk expanded into a disc-like receptacle. Before ripening, the fruit is green and distinctly 4-lobed, afterwards smooth and plump. It contains 4 one-seeded nuts[2] meeting at right angles in the middle. The seed is erect with a broad furrow on the back: in transverse section the albumen and cotyledons are seen to be curved into a horse-shoe form with the ends directed outwards.

The fresh juice is green, has an acid reaction and a sweetish, afterwards disagreeably bitter taste, and repulsive odour. It is coloured yellow by alkalis, red by acids. According to Umney[3] it should have a sp. gr. of 1·070 to 1·075, but is seldom sold pure.

Microscopic Structure—The epidermis consists of small tabular cells, followed by a row of large cubic cells and then by several layers of tangentially-extended cells rich in chlorophyll. This thick epicarp passes into the loose thin-walled and large-celled sarcocarp. Besides chlorophyll it exhibits numerous cells each containing a kind of sac, which may be squeezed out of the cell. These sacs are violet, turning blue with alkalis. Similar, yet much more conspicuous bodies occur also in the pulp of the Locust Bean (*Ceratonia Siliqua* L.)

Chemical Composition—The berries of buckthorn and other species of *Rhamnus* contain interesting colouring matters, which have been the subject of much chemical research and controversy. Winckler, in 1849 extracted from the juice *Rhamnocathartin*, a yellowish un-

[1] *Trattato dell' Agricoltura*, Milano, 1805, lib. iii. c. 58.

[2] In *R. Frangula* L., the other British species, the fruit has 2 nuts.

[3] *Pharm. Journ.* Nov. 23, 1872. 404.

crystallizable bitter substance, soluble in water but not in ether. Alkalis colour it golden yellow; perchloride of iron, dark greenish brown.

In 1840 Fleury, a pharmacien of Pontoise, discovered in buckthorn juice a yellow substance forming cauliflower-like crystals to which he gave the name of *Rhamnine*. This body has been recently studied by Lefort,[1] who identified it with the *Rhamnetine* of Galletly (1858) and the *Chrysorhamnine* of Schützenberger and Bertèche (1865). Though obtainable from the berries of all kinds of *Rhamnus* used in dyeing (including the common buckthorn), it is got most easily and abundantly from Persian Berries. When pure, and crystallized from absolute alcohol, it is described as forming minute yellow translucent tables. It is scarcely soluble in cold water, though colouring it pale yellow; is soluble in hot alcohol, insoluble in ether or bisulphide of carbon. It is very soluble in caustic alkalis, forming uncrystallizable reddish-yellow solutions. From alkaline solutions it is precipitated by a mineral acid in the form of a glutinous magma resembling hydrated silica. Lefort assigns to it the formula $C^{12}H^{12}O^5 + 2H^2O$.

This chemist has likewise found in the berries of *Rhamnus*, though not with certainty in those of *R. cathartica*, a neutral substance isomeric with rhamnine, to which he has given the name of *Rhamnegine*. Unlike rhamnine it is very soluble in cold water, but in all other respects it agrees with that body in chemical and physical properties. The two substances have the same taste, almost the same tint, the same crystalline form, and lastly they give rise to the same reactions with chemical agents.

The conclusions of Lefort have been contested by Stein (1868) and by Schützenberger (1868), the latter of whom succeeded in decomposing rhamnegine and proving it a glucoside having the formula $C^{24}H^{32}O^{14}$. Its decomposition gives rise to a body named *Rhamnetin*, $C^{12}H^{10}O^5$, and a crystallizable sugar isomeric with mannite. Schützenberger admits that the berries contain an isomeric modification of rhamnegine; but in addition another colouring matter insoluble in water, which appears to be the *Rhamnine* of Lefort, but to which he assigns a different formula, namely, $C^{18}H^{22}O^{10}$. This is also a glucoside capable of being split into rhamnetin and a sugar. There are thus, according to Schützenberger, two forms of rhamnegine which may be distinguished as α and β, and there is the substance insoluble in water, named by Lefort *Rhamnine*.

The question of the purgative principles of buckthorn, it will be observed, has not been touched by all these researches.

Uses—From the juice of the berries is prepared a syrup having strongly purgative properties, much more used as a medicine for animals than for man. The pigment *Sap Green* is also made from the juice.

AMPELIDEÆ.

UVÆ PASSÆ.

Passulæ majores; Raisins; F. *Raisins;* G. *Rosinen.*

Botanical Origin—*Vitis vinifera* L., the Common Grape-vine. It appears to be indigenous to the Caucasian provinces of Russia, that is

[1] *Sur les graines des Nerpruns tinctoriaux.—Journ. de Pharm.* iv. (1866) 420.

ıay, to the country lying between the eastern end of the Black Sea and ıe south-western shores of the Caspian; extending thence southward ıto Armenia. Under innumerable varieties, it is cultivated in most of he warmer and drier countries of the temperate regions of both the orthern and southern hemispheres. Humboldt defines the area of the rofitable culture of the vine, as a zone lying between 36° and 40° of orth latitude.

History—The vine is among the oldest of cultivated plants, and is entioned in the earliest Mosaic writings. *Dried* grapes as distinguished rom *fresh* were used by the ancient Hebrews, and in the Vulgate are ranslated *Uvæ passæ*.[1] During the middle ages, raisins were an article f luxury imported into England from Spain.

Description—The ovary of *Vitis vinifera* is 2-celled with 2 ovules n each cell; it developes into a succulent, pedicellate berry of spherical r ovoid form, in which the cells are obliterated and some of the seeds enerally abortive. As the fruit is not articulated with the rachis or he rachis with the branch, it does not drop at maturity but remains ttached to the plant, on which, provided there is sufficient solar heat, gradually withers and dries: such fruits are called *Raisins of the sun.* arious methods are adopted to facilitate the drying of the fruit, such s dipping the bunches in boiling water or in a lye of wood ashes, or wisting or partially severing the stalk,—the effect of each operation eing to arrest or destroy the vitality of the tissues. The drying performed by exposure to the sun, sometimes supplemented by rtificial heat.

The raisins commonly found in the shops are the produce of Spain nd Asia Minor, and are sold either in entire bunches or removed from he stalk. The former kind, known as *Muscatel Raisins* and imported om Malaga, are dried and packed with great care for use as a essert fruit. The latter kind, which includes the *Valencia Raisins* of pain, and the *Eleme*, *Chesme* and stoneless *Sultana Raisins* of Smyrna, e used for culinary purposes. For pharmacy, Valencia raisins are enerally employed.

Microscopic Structure—The outer layer or skin of the berry is ade up of small tabular cells loaded with a reddish granular matter, hich on addition of an alcoholic solution of perchloride of iron assumes dingy green hue. The interior parenchyme exhibits large, thin-walled, ne cells containing an abundance of crystals (bitartrate of potassium nd sugar). There are also some fibro-vascular bundles traversing the ssue in no regular order.

Chemical Composition—The pulp abounds in grape sugar and eam of tartar, each of which in old raisins may be found crystallized odular masses; it also contains gum and malic acid. The seeds ield 15 to 18 per cent. of a bland fixed oil, which is occasionally xtracted. Fritz[2] has shown that it consists of the glycerides of *Erucic cid* $(C^{22}H^{42}O^2)$, stearic acid, and palmitic acid, the first-named acid ery prevailing. The crystals of erucic acid melt at 34°C.; by means fused potash they may be resolved into arachic acid, $C^{20}H^{40}O^2$, and tic acid, $C^2H^4O^2$.

[1] Numbers vi. 3; 1 Sam. xxv. 18, xxx. 2 Sam. xvi. 1; 1 Chron. xii. 40.

[2] *Berichte d. Deutsch. Chem. Gesellsch. zu Berlin*, iv. (1871) 442.

The seeds further contain 5 to 6 per cent. of tannic acid, which also exists in the skin of the fruit. The latter is likewise the seat of chlorophyll and other colouring matter.

Commerce—The consumption of raisins in Great Britain is very large and is increasing. The imports into the United Kingdom have been as follows :—

1870.	1871.	1872.
365,418 cwt.	427,056 cwt.	617,418 cwt.
val. £593,527.	val. £707,344.	val. £1,149,337.

Of the quantity last mentioned, 400,570 cwt. were shipped from Spain, 176,500 cwt. from Asiatic Turkey, and the remainder from other countries.[1]

Uses—Raisins are an ingredient of Compound Tincture of Cardamoms and of Tincture of Senna. They have no medicinal properties and are only used for the sake of the saccharine matter they impart.[2]

ANACARDIACEÆ.

MASTICHE.

Mastix, Resina Mastiche ; Mastich ; F. *Mastic ;* G. *Mastix.*

Botanical Origin—*Pistacia Lentiscus* L., the lentisk, is a diœcious evergreen, mostly found as a shrub a few feet high ; but when allowed to attain its full growth, it slowly acquires the dimensions of a small tree having a dense head of foliage. It is a native of the Mediterranean shores from Syria to Spain, and is found in Portugal, Morocco and the Canaries. In some parts of Italy it is largely cut for fuel.

Mastich is collected in the northern part of the island of Scio, which was long regarded as the only region in the world capable of affording it. Experiments made in 1856 by Orphanides[3] have proved that excellent mastich might be easily obtained in other islands of the archipelago, and probably also in Continental Greece. The same botanist remarks that the trees yielding mastich in Scio are exclusively *male.*

History—Mastich has been known from a very remote period and is mentioned by Theophrastus[4] who lived in the 4th century before the Christian era. Both Dioscorides and Pliny notice it as a production of the island of Chio, the modern Scio.

Avicenna[5] described (A.D. 1000–1037) two sorts of mastich, the white or Roman (i.e. *Mediterranean* or *Christian*), and the dark or Nabathæan,—the latter probably one of the Eastern forms of the drug mentioned at p. 145.

Benjamin of Tudela[6] who visited the island of Scio when travelling

[1] *Annual Statement of the Trade of the United Kingdom for* 1872.

[2] The amount of this is very small. On macerating crushed raisins in proof spirit in the proportion of 2 oz. to a pint, we found each fluid ounce of the tincture so obtained to afford by evaporation to dryness 28 grains of a dark viscid sugary extract.

[3] Heldreich, *Nutzpflanzen Griechenlands*, Athen, 1862. 61.

[4] *Hist. Plant.* lib. ix. c. 1.

[5] Lib. ii. c. 462.

[6] Wright, *Early Travels in Palestine*, 1848. 77. (Bohn's series.)

East about A.D. 1169–1173, also refers to it yielding mastich, in fact has always been one of its most important productions, m the earliest times intimately connected with its history.

the middle ages, the mastich of Scio was held as a monopoly by ek emperors, one of whom, Michael Paleologus in 1261, permitted noese to settle in the island. His successor Andronicus II. ed in 1304 the administration of the island to Benedetto Zaccaria, patrician of Genoa and the proprietor of the alum works of Fokia cient Phocæa), north-west of Smyrna, for ten years, renouncing ute during that period. The concession was very lucrative, a large e being derived from the *Contrata del Mastico* or Mastich district; e Zaccaria family taking advantage of the weakness of the emperor ined to hold it as long as possible. In fact they made themselves l sovereigns of Scio and of some of the adjacent islands, and d their position until expelled by Andronicus III. in 1329.[1]

e island was retaken by the Genoese under Simone Vignosi in and then by a remarkable series of events became the property association called the *Maona*. Many of the noblest families of enrolled themselves in this corporation and settled in the island ; and in order to express the community of interest that governed proceedings, some of them relinquished their family names and d the general name of *Giustiniani*.[2] This extraordinary society a part exactly comparable to that of the late East India ny. In Genoa it had its "*Officium Chii*"; it had its own ution and mint, and it engaged in wars with the emperors of ntinople, the Venetians and the Turks, who in turn attacked and l the mastich island and adjacent possessions.

e Giustinianis regulated very strictly the culture of the lentisk e gathering and export of its produce, and cruelly punished all rs. The annual export of the drug was 300 to 400 quintals,[3] were immediately assigned to the four regions with which the chiefly traded. These were *Romania* (*i.e.* Greece, Constanti- and the Crimea), *Occidente* (Italy, France, Spain and Germany), *Turchia* (Asia Minor), and *Oriente* (Syria, Egypt and Northern . In 1364, a quintal was sold for 40 *lire*; in 1417, the price was t 25 *lire*. In the 16th century, the whole income from the drug ,000 ducats (£13,750)[4] a large sum for that period.

1566, the Giustinianis definitively lost their beautiful island, the under Piali Pasha taking it by force of arms under pretext that stomary tribute was not duly paid.[5] A few years before that

[1] Jordanus who visited Scio *circa* noticed the production of mastich, the loss of the island by Martino —*Mirabilia descripta, or Wonders* *East*, edited by Col. Yule for the Society, 1863.

ably partly for the reason that the ni palace in Genoa had become the of the Society.

accidental notice showing the value le occurs in the letter of Columbus a Genoese) announcing the result st voyage to the Indies. In stating y he obtained from the island of la, he mentions—gold and spices . . and *mastich*, hitherto found only in Greece in the island of Scio, and which the Signoria sells at its own price, as much as their Highnesses [Ferdinand and Isabella] shall command to be shipped. The letter bears date 15 Feb. 1493.—*Letters of Christ. Columbus* (Hakluyt Society) 1870, p. 15.

[4] The ducat being reckoned at 9*s.* 2*d.*

[5] For further particulars respecting the history of Scio, the Maona, and the trade of the Genoese in the Levant, see Hopf in Ersch and Gruber's *Encyclopædie*, vol. 68 (Leipzig 1859) art. *Giustiniani*; also Heyd, *Colonie commerciali degli Italiani in Oriente*, i. (1866).

event, it was visited by the French naturalist Belon[1] who testifies from personal observation to the great care with which the lentisk was cultivated by the inhabitants.

When Tournefort[2] was at Scio in 1701, all the lentisk trees on the island were held to be the property of the Grand Signor, and if any land was sold, the sale did not include the lentisks that might be growing on it. At that time the mastich villages, about twenty in number, were required to pay 286 chests of mastich annually to the Turkish officers appointed to receive the revenue.

The month of January, 1850, was memorable throughout Greece and the Archipelago for a frost of unparalleled severity which proved very destructive to the mastich trees of Scio, and occasioned a scarcity of the drug that lasted for many years.[3]

The disuse into which mastich has fallen makes it difficult to understand its ancient importance; but a glance at the pharmacopœias of the 15th, 16th, and 17th centuries shows that it was an ingredient of a large number of compound medicines.[4]

Secretion—In the bark of the stems and branches of the mastich shrub, there are resin-ducts like those in the aromatic roots of *Umbelliferæ* or *Compositæ*. In *Pistacia* they may even be shown in the petioles. The wood is devoid of resin,[5] so that slight incisions are sufficient to provoke the resinous exudation, the bark being not very thick, and liable to scale off.

Collection—In Scio incisions are made about the middle of June in the bark of the stems and principal branches. From these incisions, which are vertical and very close together, the resin speedily flows, and soon hardens and dries. After 15 to 20 days it is collected with much care in little baskets lined with white paper or clean cotton wool. The ground below the trees is kept hard and clean, and flat pieces of stone are often laid on it that the droppings of resin may be saved uninjured by dirt. There is also some spontaneous exudation from the small branches which is of very fine quality. The operations are carried on by women and children and last for a couple of months. A fine tree may yield as much as 8 to 10 pounds of mastich.

The dealers in Scio distinguish three or four qualities of the drug, of which the two finer are called κυλιστὸ and φλισκάρι, that collected from the ground πῆττα, and the worst of all φλοῦδα.[6]

Description—The best sort of mastich consists of roundish tears about the size of small peas, together with pieces of an oblong or pear-shaped form. They are of a pale yellow tint darkening by age, dusty and slightly opaque on the surface but perfectly transparent within.

[1] *Observations de plusieurs singularitez et choses mémorables trouvées en Grèce*, etc. Paris, 1554. liv. i. ch. 8.

[2] *Voyage into the Levant*, i. (1718) 285.

[3] At Athens the mercury was for a short time at −10° C. (14° F.) In Scio, where the frost was probably quite as severe, though we have no exact data, the mischief to the lentisks varied with the locality, trees exposed to the north or growing at considerable elevations, being killed down to the base of the trunk, while those in more favoured positions suffered destruction only in some of their branches.

[4] Thus in the *London Pharmacopœia* of 1632, mastich enters into 24 of the 37 different kinds of pill, besides which it is prescribed in troches and ointments.

[5] See Unger and Kotschy, *Die Insel Cypern*, Wien, 1865. 424.

[6] Heldreich (and Orphanides) *Nutzpflanzen Griechenlands*, Athen, 1862 60.

astich of late imported has been washed; the tears are no longer but have a glassy transparent appearance. Mastich is brittle, conchoidal fracture, a slight terebinthinous balsamic odour. It ly softens in the mouth and may be easily masticated and kneaded n the teeth, in this respect differing from sandarac, a tear of which to powder when bitten.

erior mastich is less transparent and consists of masses of larger d less regular shape, often contaminated with earthy and vegetable ties.

e sp. gr. of selected tears of mastich is about 1·06. They soften C. but do not melt below 108°.

stich dissolves in half its weight of pure warm acetone and then s the ray of polarized light to the right. On cooling, the solu- ecomes turbid. It dissolves slowly in 5 parts of oil of cloves, g even in the cold a clear solution; it is but little soluble in acetic acid or in benzol.

emical Composition—Mastich is soluble to the extent of about cent. in cold alcohol; the residue, which has been termed *Masticin* *-resin of Mastich*, is a translucent, colourless, tough substance, le in boiling alcohol or in solution of caustic alkali, but dissolving r or oil of turpentine. According to Johnston, it is somewhat h in oxygen than the following.

soluble portion of mastich called *Alpha-resin of Mastich* es acid properties, and like many other resins has the formula O^2. Its alcoholic solution is precipitated by an alcoholic solu- neutral acetate of lead. Mastich contains a very little volatile

mmerce—Mastich still forms the principal revenue of Scio, from island the export in 1871 was 28,000 lb. of *picked*, and 42,000 lb. *non*. The market price of picked mastich was equal to 6*s.* 10*d.* —that of common 2*s.* 10*d.* The superior quality is sent to Turkey, lly Constantinople, also to Trieste, Vienna, and Marseilles, and a quantity to England. The common sort is employed in the East manufacture of *raki* and other cordials.[1]

es—Mastich is not now regarded as possessing any important utic virtues, and as a medicine is becoming obsolete. Even in -making it is no longer employed as formerly, its place being pplied by less costly resins, such for example as dammar.

rieties—There is found in the Indian bazaars a kind of mastich though called *Mustagi-rúmí* (Roman mastich), is not imported urope but from Kábul, and is the produce of *Pistacia Khinjuk* and the so-called *P. Cabulica* St., trees growing all over Sind, istán and Kábul.[2] This drug of which the better qualities closely imate to the mastich of Scio, sometimes appears in the European under the name of *East Indian* or *Bombay Mastich*. We find en dissolved in half its weight of acetone or benzol, it deviates of light to the right.

solid resin of the Algerian form of *P. Terebinthus* L., known as

[1] Cumberbatch, *Report on Trade* s for 1871.

[2] Powell, *Economic Products of the Punjab*, Roorkee, 1868. 411.

P. Atlantica Desf., is collected and used as mastich by the Arab tribes of Northern Africa.[1]

TEREBINTHINA CHIA.

Terebinthina Cypria; Chian or Cyprian Turpentine; F. *Térébenthine ou Baume de Chio ou de Chypres*; G. *Chios Terpenthin, Cyprischer Terpenthin.*

Botanical Origin—*Pistacia Terebinthus* L. (*P. Atlantica* Desf., *P. Palæstina* Boiss., *P. Cabulica* Stocks), a tree 20 to 40 feet or more in height, in some countries only a shrub, common on the islands and shores of the Mediterranean as well as throughout Asia Minor, extending, as *P. Palæstina*, to Syria and Palestine; and eastward, as *P. Cabulica*, to Belúchistán and Afghanistan. It is found under the form called *P. Atlantica* in Northern Africa, where it grows to a large size, and in the Canary Islands.

These several forms are mostly regarded as so many distinct species; but after due consideration and the examination of a large number of specimens both dried and living, we have arrived at the conclusion that they may fairly be united under a single specific name. The extreme varieties certainly present great differences of habit, as anyone would observe who had compared *Pistacia Terebinthus* as the straggling bush which it is in Languedoc and Provence, with the noble umbrageous tree it forms in the neighbourhood of Smyrna. But the different types are united by so many connecting links, that we have felt warranted in dissenting from the opinion usually held respecting them.

History—The terebinth was well known to the ancients; it is the τέρμινθος of Theophrastus, τερέβινθος of other authors, and the *Alah* of the Old Testament.[2] Among its products, the kernels were regarded by Dioscorides as unwholesome, though agreeable in taste. By pressing them, the original *Oil of Turpentine*, τερεβίνθινον ἔλαιον, a mixture of essential and fat oil was obtained, as it is in the East to the present day. The resinous juice of the stem and branches, the true, primitive turpentine, ῥητίνη τερμινθίνη, was celebrated as the finest of all analogous products, and preferred both to mastich and the pinic resins. To the latter however the name of turpentine was finally applied.[3]

By the puncture of an hemipterous insect, *Aphis Pistaciæ* L., a horn shaped gall, often several inches in length, is produced on the branches, while a much smaller gall of different shape is formed (by the same insect?) on the ribs of the leaves. The first named, called by pharmacological writers *Gallæ vel Folliculi Pistacinæ*, and in Italian *Carobbe di Giudea*, were formerly used in medicine and in dyeing.[4]

Collection—The resinous juice is secreted in the bark, according to Unger,[5] in special cells precisely as mastich in *P. Lentiscus*. That found in commerce is collected in the island of Scio. To some extent it exudes spontaneously, yet in greater abundance after incisions made

[1] Guibourt, *Hist. d. Drog.* iii. (1850) 458; Armieux, *Topographie médicale du Sahara*, Paris, 1866. 58.

[2] Genesis xii. 6, where the word is rendered in our version *plain*.

[3] Further historical information on the Terebinth may be found in Hehn's *Kulturpflanzen und Hausthiere*. Berlin, 1870. 3[illegible]

[4] Analysis by Martius may be found in Liebig's *Ann. d. Pharm.* xxi. (1837) 17[illegible]

[5] Unger u. Kotschy, *die Insel Cypern*. 1865. 361. 424.

stem and branches. This is done in spring, and the resin continues low during the whole summer; but the quantity is so small that not e than 10 or 11 ounces are obtained from a large tree in the course year. The turpentine, hardened by the coolness of the night, is ped from the stem down which it has flowed, or from flat stones ed at the foot of the tree to receive it. As it is when thus col-ed, always mixed with foreign substances, it is purified to some ent by straining through small baskets, after having been liquefied exposure to the sun.

When Tournefort[1] visited Scio in 1701, the island was said to produce rely 300 okes (850 lb.) annually, which is about the quantity it is posed to yield at present. The trade is asserted to be almost exclu-ly in the hands of Jews, who dispose of the drug in the interior part the Turkish Empire.[2]

Description—A specimen collected by Maltass near Smyrna in 58 was after ten years, of a light yellowish colour, scarcely fluid though fectly transparent, nearly of the same odour as melted colophony or stich, and without much taste. We found it readily soluble in spirit wine, amylic alcohol, glacial acetic acid, benzol, or acetone, the tion in each case being very slightly fluorescent. The alcoholic tion reddens litmus, and is neither bitter nor acrid. Two parts of genuine turpentine dissolved in one of acetone deviate a ray of polar-l light 7° to the right,[3] in a column 50 mm. long.

Chian turpentine as found in commerce and believed to be genuine, soft solid, becoming brittle by exposure to the air; viewed in mass appears opaque and of a dull brown hue. If pressed while warm ween two slips of glass, it is seen to be transparent, of a yellowish wn, and much contaminated by various impurities in a state of fine ision. It has an agreeable, mild terebinthinous odour and very little te. The whitish powder with which old Chian turpentine becomes ered, shows no trace of crystalline structure when examined under microscope.

Chemical Composition—Chian turpentine consists of resin and ential oil. The former is probably identical with the *Alpha-resin* of stich. The *Beta-resin* or *Masticin* appears to be absent, for we find Chian turpentine deprived of its essential oil by a gentle heat, dis-es entirely (impurities excepted) in alcohol sp. gr. 0·815, which is no means the case with mastich.

The essential oil which we obtained by distilling with water 64 ounces Chian turpentine of authentic origin, amounted to nearly 14½ per cent. has the odour of the drug; sp. gr. 0·869; boiling point 161° C.; it iates the ray of polarized light 12·1° to the right. In common with pentine oils of the *Coniferæ*, it contains a small amount of an genated oil, and is therefore vividly attacked by sodium. When reaction is over and the oil is again distilled, it boils at 157° C. has a sp. gr. of 0·862. It has now a more agreeable odour, re-bling a mixture of cajuput, mace, and camphor, and nearly the e rotatory power (11·5° to the right). By saturation with dry hydro-

[1] *Voyage into the Levant*, i. (1718) 287.
[2] Maltass, *Pharm. Journ.* xvii. (1858)
[3] A solution of mastich made in the same proportion deviates 3° to the right.

chloric acid, it does not yield a solid compound. After treatment with sodium and rectification, it was found[1] to consist of C 88·75, H 11·40 per cent., which is the composition of oil of turpentine.

Uses—Chian Turpentine appears to have exactly the properties of the pinic turpentines; in British medicine it is almost obsolete. In Greece it is sometimes added to wine or used to flavour cordials, in the same manner as turpentine of the pine, or mastich.

LEGUMINOSÆ.

HERBA SCOPARII.

Cacumina vel Summitates Scoparii; Broom Tops; F. *Genêt à balais;* G. *Besenginster, Pfriemenkraut.*

Botanical Origin—*Cytisus Scoparius* Link (*Spartium Scoparium* L., *Sarothamnus vulgaris* Wimmer), the Common Broom, a woody shrub, 3 to 6 feet high, grows gregariously in sandy thickets and uncultivated places throughout Great Britain, and Western and temperate Northern Europe. In continental Europe it is plentiful in the valley of the Rhine up to the Swiss frontier, in Southern Germany and in Silesia, but does not ascend the Alps, and is absent from many parts of Central and Eastern Europe. According to Ledebour, it is found in Central and Southern Russia and on the Eastern side of the Ural Mountains. In Southern Europe its place is supplied by other species.

History—From the fact that this plant is chiefly a native of Western, Northern and Central Europe, it is improbable that the classical authors were acquainted with it; and for the same reason the remarks of the early Italian writers may not always apply to the species under notice. With this reservation, we may state that broom under the name *Genista, Genesta,* or *Genestra* is mentioned in the earliest printed herbals, as that of Passau,[2] 1485, the *Hortus Sanitatis,* 1491, the *Great Herbal* printed at Southwark in 1526, and others. Broom was used in ancient Anglo-Saxon medicine.[3] It had a place in the London Pharmacopœia of 1618, and has been included in nearly every subsequent edition. Hieronymus Brunschwyg (1515) gives directions for distilling a water from the flowers,—a medicine which Gerarde relates was used by King Henry VIII. "against surfets and diseases thereof arising."

Broom was the emblem of those of the Norman sovereigns of England descended from Geoffroy Plantagenet, count of Anjou, who died A.D. 1150.

Description—The Common Broom has numerous straight ascending wiry branches, sharply 5-angled and devoid of spines. The leaves, of which the largest are barely an inch long, consist of 3 obovate leaflets on a petiole of their own length. Towards the extremities of the twigs, the leaves are much scattered and generally reduced to a single ovate leaflet, nearly sessile. The leaves when young are clothed on

[1] From an analysis performed in my laboratory by Dr. Kraushaar.—F. A. F.

[2] *Herbarius Patavie,* 1485.

[3] Cockayne, *Leechdoms,* &c. iii. (1866) 316.

th sides with long reddish hairs; these under the microscope are seen ich to consist of a simple cylindrical thin-walled cell, the surface of hich is beset with numerous extremely small protuberances.

The large, bright-yellow, odorous flowers, which become brown in rying, are mostly solitary in the axils of the leaves; they have a ersistent campanulate calyx divided into two lips minutely toothed, nd a long subulate style, curved round on itself. The legume is oblong, ompressed, 1½ to 2 inches long by about ½ an inch wide, fringed with airs along the edge. It contains 10 to 12 olive-coloured albuminous eeds, the funicle of which is expanded into a large fleshy strophiole. They have a bitterish taste, and are devoid of starch.

The portion of the plant used in pharmacy is the younger herbaceous ranches, which are required both fresh and dried. In the former state hey emit when bruised a peculiar odour which is lost in drying. They ave a nauseous bitter taste.

Chemical Composition—Stenhouse[1] discovered in broom tops wo interesting principles, *Scoparin*, $C^{21}H^{22}O^{10}$, an indifferent or somehat acid body, and the alkaloid *Sparteine*, $C^{15}H^{26}N^2$, the first soluble n water or spirit and crystallizing in yellowish tufts, the second a olourless oily liquid heavier than water and sparingly soluble in it, oiling at 288°C.

To obtain scoparin, a watery decoction of the plant is concentrated o as to form a jelly after standing for a day or two. This is then ashed with a small quantity of cold water, dissolved in hot water and gain allowed to repose. By repeating this treatment with the ddition of a little hydrochloric acid, the chlorophyll may at length be parated and the scoparin obtained as a gelatinous mass, which dries as n amorphous, brittle, pale yellow, neutral substance, devoid of taste nd smell. Its solution in hot alcohol deposits it partly in crystals and artly as jelly, which after drying are alike in composition. Hlasiwetz owed (1866) that scoparin when melted with potash is resolved like ino or quercetin into *Phloroglucin*, $C^6H^6O^3$, and *Protocatechuic Acid*, $C^7H^6O^4$.

The acid mother-liquors from which scoparin has been obtained, hen concentrated and distilled with soda, yield besides ammonia a ry bitter oily liquid, *Sparteine*. To obtain it pure, it requires to be peatedly rectified, dried by chloride of calcium, and distilled in a rrent of dry carbonic acid. It is colourless, but becomes brown by posure to light; it has at first an odour of aniline, but this is altered r rectification. Sparteine has a decidedly alkaline reaction and readily utralizes acids, forming crystallizable salts which are extremely bitter. nine, nicotine, and sparteine are the only volatile alkaloids devoid oxygen hitherto known to exist in the vegetable kingdom.

Mills[2] extracted sparteine simply by acidulated water, which he ncentrated and then distilled with soda. The distillate was then urated with hydrochloric acid, evaporated to dryness, and submitted distillation with potash. The oily sparteine thus obtained was dried prolonged heating with sodium in a current of hydrogen, and finally tified *per se*. Mills succeeded in replacing one or two equivalents of hydrogen of sparteine by one or two of C^2H^5 (ethyl). From 150 lb.

[1] *Phil. Trans.*, 1851. 422-431.

[2] *Journ. of Chem. Soc.* xv. (1862) 1 *Gmelin's Chem.*, xvi. (1864) 292.

of the (dried?) plant, he obtained 22 cubic centimetres (fʒvj.) of sparteine, which we may estimate as equivalent to about ½ per mille.

Stenhouse ascertained that the amount of sparteine and scoparin depends much on external conditions, broom grown in the shade yielding less than that produced in open sunny places. He states that shepherds are well aware of the shrub possessing narcotic properties, from having observed their sheep to become stupified and excited when occasionally compelled to eat it.

The experiments of Reinsch (1846) tend to show that broom contains a bitter crystallizable principle in addition to the foregoing. It is well known that the seeds of the allied *Cytisus Laburnum* L. afford two highly poisonous alkaloids, *Cytisine* and *Laburnine*, discovered by A. Husemann and Marmé in 1865.

Uses—A decoction of broom tops, made from the dried herb, is used as a diuretic and purgative. The juice of the fresh plant preserved by the addition of alcohol, is also administered and is regarded as a very efficient preparation.

SEMEN FŒNI-GRÆCI.

Semen Fœnugræci; Fenugreek; F. *Semences de Fenugrec;* G. *Bockshornsamen.*

Botanical Origin—*Trigonella Fœnum-græcum* L., an erect, subglabrous, annual plant 1 to 2 feet high, with solitary, subsessile, white flowers; indigenous to the countries surrounding the Mediterranean, in which it has been long cultivated and whence it appears to have spread to India.

History—This plant was well known to the Roman writers on husbandry, as Porcius Cato (B.C. 234–149) who calls it *Fœnum Græcum* and directs it to be sown as fodder for oxen. Its mucilaginous seeds were valued as an aliment and condiment for man, and as such are still largely consumed in the East. They were likewise supposed to possess many medicinal virtues and had a place in the pharmacopœias of the last century.

The cultivation of fenugreek in Central Europe was encouraged by Charlemagne (A.D. 812), and the plant was grown in English gardens in the 16th century.

Description—The fenugreek plant has a sickle-shaped pod, 3 to 4 inches long, containing 10 to 20 hard, brownish-yellow seeds, having the smell and taste which is characteristic of peas and beans, with addition of a cumarin- or melilot-flavour.

The seeds are about ⅛ of an inch long, with a rhomboid outline, often shrivelled and distorted; they are somewhat compressed, with the hilum on the sharper edge, and a deep furrow running from it and almost dividing the seed into two unequal lobes. When the seed is macerated in warm water its structure becomes easily visible. The testa bursts by the swelling of the internal membrane or endopleura, which like a thick gelatinous sac encloses the cotyledons and their very large hooked radicle.

Microscopic Structure—The most interesting structural peculiarity of this seed arises from the fact that the mucilage with which it

ounds, is not yielded by the cells of the epidermis but by a loose sue closely surrounding the embryo.

Chemical Composition—The cells of the testa contain tannin; e cotyledons a yellow colouring matter, but no sugar. The air-dried eds give off 10 per cent. of water at 100° C., and on subsequent cineration leave 7 per cent. of ash, of which nearly a fourth is osphoric acid.

Ether extracts from the pulverized seeds 6 per cent. of a fœtid, tty oil having a bitter taste. Amylic alcohol removes in addition a all quantity of resin. Alcohol added to a concentrated aqueous tract, forms a precipitate of mucilage, amounting when dried to 28 er cent. Burnt with soda-lime, the seeds yielded to Jahns[1] 3·4 per nt. of nitrogen, equivalent to 22 per cent. of albumin. No researches ave been yet made to determine the nature of the odorous principle.

Production and Commerce—Fenugreek is cultivated in Morocco, the south of France near Montpellier, in Alsace, in a few places in witzerland, and in some provinces of the German and Austrian empires, Thuringia and Moravia. It is produced on a far larger scale in Egypt, here it is known by the Arabic name *Helbeh*, and whence it is exported o Europe and India.

Under the Sanskrit name of *Methi* which has passed into several of he modern Indian languages, fenugreek is much grown in the plains of India during the cool season. In the year 1872–73, the quantity of ed exported from Sind to Bombay was 13,646 cwt., valued at £4,405.[2] From the port of Bombay, there were shipped in the same year 9,655 wt., of which only 100 cwt. are reported as for the United Kingdom.[3]

Uses—In Europe fenugreek as a medicine is obsolete, but the owdered seeds are still often sold by druggists for veterinary pharmacy nd as an ingredient of curry-powder. The chief consumption is owever in the so-called *Cattle Foods*.

The fresh plant in India is commonly eaten as a green vegetable, hile the seeds are extensively used by the natives in food and edicine.

TRAGACANTHA.

ummi Tragacantha; Tragacanth, Gum Tragacanth; F. *Gomme Adragante;* G. *Traganth.*

Botanical Origin—Tragacanth is the gummy exudation from the em of several species of *Astragalus*, belonging to the sub-genus *ragacantha*. The plants of this group are low perennial shrubs, markable for their leaves having a strong, persistent, spiny petiole. s the leaves and shoots are very numerous and regular, many of the ecies have the singular aspect of thorny hemispherical cushions, lying ose on the ground; while others, which are those furnishing the gum, ow erect with a naked woody stem, and somewhat resemble furze ushes.

[1] Experiments performed in my laboratory 1867.—F. A. F.

[2] *Annual Statement of the Trade and Navigation of Sind*, for the year 1872–73, printed at Karachi 1873. p. 36.

[3] *Annual Statement*, &c. Bombay, 1873. 89.

A few species occur in South-western Europe, others are found in Greece and Turkey; but the largest number are inhabitants of the mountainous regions of Asia Minor, Syria, Armenia, Kurdistan and Persia. The tragacanth of commerce is produced in the last-named countries, and chiefly, though not exclusively, by the following species[1]:—

1. *Astragalus adscendens* Boiss. et Haussk., a shrub attaining 4 feet in height, native of the mountains of South-western Persia at an altitude of 9,000 to 10,000 feet. According to Haussknecht, it affords an abundance of gum.

2. *A. brachycalyx* Fisch., a shrub of 3 feet high, growing on the mountains of Persian Kurdistan, likewise affords tragacanth.

3. *A. gummifer* Labil., a small shrub of wide distribution occurring on the Lebanon and Mount Hermon in Syria, the Beryt Dagh in Cataonia, the Arjish Dagh (Mount Argæus) near Kaisariyeh in Central Asia Minor, and in Armenia and Northern Kurdistan.

4. *A. microcephalus* Willd., like the preceding a widely distributed species, extending from the south-west of Asia Minor to the north-east coast, and to Turkish and Russian Armenia. A specimen of this plant with incisions in the stem, was sent some years ago to the Pharmaceutical Society by Mr. Maltass of Smyrna. We have lately received a large example of the same species, the stem of which is marked by old incisions, from the Rev. W. A. Farnsworth of Kaisariyeh, who states that tragacanth is collected from it on Mount Argæus.

5. *A. pycnocladus* Boiss. et Haussk., nearly related to *A. microcephalus*; it was discovered on the high mountains of Avroman and Shahu in Persia by Professor Haussknecht, who states that it exudes tragacanth in abundance.

6. *A. stromatodes* Bunge, growing at an elevation of 5,000 feet on the Akker Dagh range, near Marash in Northern Syria.

7. *A. Kurdicus* Boiss., a shrub 3 to 4 feet high, native of the mountains of Cilicia and Cappadocia, extending thence to Kurdistan. Professor Haussknecht has informed us that from this and the last-named species, the so-called *Aintab Tragacanth* is chiefly obtained.

8. *A. Cylleneus* Boiss. et Heldr., a small shrub found in abundance on the northern mountains of the Morea, is stated by Heldreich to be the almost exclusive source of the tragacanth collected about Vostizza and Patras.

History—Tragacanth has been known from a very early period. Theophrastus in the 3rd century B.C. mentioned Crete, the Peloponnesus and Media as its native countries. Dioscorides who as a native of South-eastern Asia Minor was probably familiar with the plant, describes it correctly as a low spiny bush. The drug is mentioned by the Greek physicians Oribasius, Aëtius, and Paulus Ægineta (4th to 7th cent.), and by many of the Arabian writers on medicine. During the middle ages it was imported into Europe through the trading cities of Italy, as shown in the statutes of Pisa,[2] A.D. 1305, where it is mentioned as liable to impost.

[1] As described in Boissier's *Flora Orientalis*, ii. (1872). We have to thank Professor Haussknecht of Weimar for revising our list of species, and for some valuable information as to the localities in which the drug is produced.

[2] Bonaini, *Statuti inediti della città di Pisa dal xii. al xiv. secolo*, iii. (1857) 106. 114.

Belon, the celebrated French naturalist and traveller, saw and about 1550, the collecting of tragacanth in the northern part linor; and Tournefort in 1700 observed on Mount Ida in e singular manner in which the gum is exuded from the nt.[1]

:ion—It has been shown by H. von Mohl[2] and by Wigand[3] that is produced by a metamorphosis of the cell membrane, and ıot simply the dried juice of the plant.

:m of a gum-bearing *Astragalus* cut transversely, exhibits con- ıual layers which are extremely tough and fibrous, easily tearing : into thin filaments. These inclose a central column, radi- ı which are numerous medullary rays, both of very singular for instead of presenting a thin-walled parenchyme, they the naked eye as a hard translucent gum-like mass, be- ·latinous in water. Examined microscopically, this gummy is seen to consist not of dried mucilage, but of the very e pith and medullary rays, in process of transformation into . The transformed cells, if their transformation has not too far, exhibit the angular form and close packing of paren- ls, but their walls are much incrassated and evidently consist ıus very thin strata.

hese cells are but ordinary parenchyme-cells in an altered roved by the pith and medullary rays of the smaller branches ɜent no such unusual structure. Von Mohl was able to trace e from the period in which the original cell-membrane could sily distinguished from its incrusting layers, to that in which ormation had proceeded so far that it was impossible to ny defined cells, the whole substance being metamorphosed 'e or less uniform mucilaginous mass.

nsion under which this peculiar tissue is held in the interior ·m, is very remarkable in *Astragalus gummifer* Labil., which (H.) had the opportunity of observing on the Lebanon in 1860. ; off a branch of the thickness of the finger, there immediately m the centre, a stream of soft, solid tragacanth, pushing itself worm, to the length of ¾ of an inch, sometimes in the course ı hour; while much smaller streams (or none at all) are om the medullary rays of the thick bark.

ıction—The principal localities in Asia Minor in which ı is collected are the district of Angora, the capital of the alatia; Isbarta, Buldur and Yalavatz,[4] north of the gulf of ıe range of the Ali Dagh between Tarsous and Kaisariyeh, and ainous country eastward as far as the valley of the Euphrates. is also gathered in Armenia on the elevated range of the ıgh south of Erzerum; throughout Kurdistan from Mush ıiles in a south-eastern direction as far as the province of in Persia, a region including the high lands south of lake west of lake Urumiah. It is likewise produced in Persia st, over an area 300 miles long by 100 to 150 miles broad,

[1] *into the Levant*, Lond., i. (1718)

[2] *ke Zeitung*, 1857. 33; *Pharm.* (1859) 370.

[3] Pringsheim's *Jahrbücher f. wissenschaftl. Botanik*, iii. (1861) 117.

[4] *Pharm. Journ.* xv. (1856) 18.

between Gilpaigon and Kashan, southward to the Mahomed Senna range north-east of Shiraz, thus including the lofty Bakhtiyari mountains.

As to the way in which the gum is obtained, it appears from the statements of Maltass, that in July and August the peasants clear away the earth from around the stem of the shrub and then make in the bark several incisions, from which during the following 3 or 4 days the gum exudes, and dries in flakes. In some localities they also puncture the bark with the point of a knife. Whilst engaged in these operations, they pick from the shrubs whatever gum they find exuded naturally.

Hamilton,[1] who saw the shrub in 1836 on the hills about Buldur, says "the gum is obtained by making an incision in the stem near the root, and cutting through the pith, when the sap exudes in a day or two and hardens."

Formerly the peasants were content to collect the naturally exuded gum, no pains being taken to make incisions, whereby alone white flaky gum is obtained. We have in fact heard an old druggist state, that he remembered the first appearance of this fine kind of tragacanth in the London market. According to Professor Haussknecht, whose observations relate chiefly to Kurdistan and Persia, the tragacanth collected in those regions is mostly a spontaneous exudation.

Tragacanth is brought to Smyrna, which is a principal market for it, from the interior, in bags containing about 2 quintals each, by native dealers who purchase it of the peasants. In this state it is a very crude article consisting of all the gatherings mixed together. To fit it for the European markets, some of which have their special requirements, it has to be sorted into different qualities, as *Flaky or Leaf Gum*, *Vermicelli* and *Common* or *Sorts;* this sorting is performed almost exclusively by Spanish Jews.

Description—The peculiar conditions under which tragacanth exudes, arising from the pressure of the surrounding tissues and the power of solidifying a large amount of water, will account to some extent for the strange forms in which this exudation occurs.

The spontaneously exuded gum is mostly in mammiform or botryoidal masses from the size of a pea upwards, of a dull waxy lustre, and brownish or yellowish hue. It also occurs in vermiform pieces more or less contorted and very variable in thickness; some of them may have exuded as the result of artificial punctures. It is this form that bears the trade name of *Vermicelli*. The most valued sort is however the *Flake Tragacanth*, which consists of thin flattish pieces or flakes, 1, 2, 3 or more inches in length, by ¼ to 1 inch in width.[2] They are marked on the surface by wavy lines and bands, or by a series of concentric wave-marks as if the soft gum had been forced out by

[1] *Researches in Asia Minor, Pontus and Armenia*, i. (1842) 492.

[2] In the Museum of the Pharmaceutical Society in London, there is some Flake Tragacanth remarkable for its enormous size, but in other respects precisely like the ordinary kind. The ribbon-like strips are as much as 2 inches wide and $\frac{1}{16}$ of an inch thick, and the largest which is several inches long weighs 2¾ ounces. Professor Haussknecht has informed us that he has seen in Luristan, stems of *Astragalus criostylus* Boiss. et Haussk. more than 6 feet in height and 5 inches in diameter, and bearing tragacanth. It is probable that the specimen of gum we have described was produced by some species attaining these extraordinary dimensions. Among the Kurdistan tragacanth, there occur curious cylindrical vermiform pieces, about ¼ of an inch in diameter, coated with a network of woody fibre. We are told by Professor H. that they are picked out of the centre of cut-off pieces of stem, split open by rapid drying in the sun.

ıccessive efforts. The pieces are contorted and altogether very variable ı form and size. The gum is valued in proportion to its purity and hiteness. The best, whether vermiform or flaky, is dull-white, anslucent, devoid of lustre, somewhat flexible and horny, firm, and ot easily broken, inodorous and with scarcely any or only a slight itterish taste.

The tragacanth of Kurdistan and Persia shipped from Bagdad, which metimes appears in the London drug sales under the incorrect name of *yrian Tragacanth*, is in very fine and large pieces which are rather ore translucent and ribbon-like than the selected tragacanth imported om Smyrna: in fact, the two varieties when seen in bulk are easily istinguishable.

The inferior kinds of tragacanth have more or less of colour, and are ontaminated with bark, earth and other foreign substances.

Microscopic Structure—The transformation of the cells into ragacanth is usually not so complete, that every trace of the original issue or its contents has disappeared. In the ordinary drug, the remains f cell-walls as well as starch granules may be seen, especially if thin lices are examined under oil or any other liquid not acting on the gum. Polarized light will then distinctly show the starch and the cell-walls. If a thin section is imbued with a solution of iodine in iodide of potassium and then moistened with concentrated sulphuric acid, the cell-walls will assume a blue colour as well as the starch.

Chemical Composition—When tragacanth is immersed in water it swells, and in the course of some hours disintegrates so that it can be diffused through the liquid. So great is its power of absorbing water that even with 50 times its weight, it forms a thick mucilage. If one part of tragacanth is shaken with 100 parts of water and the liquid filtered, a neutral solution may be obtained which yields an abundant precipitate with acetate of lead, and mixes clearly with a concentrated solution of ferric chloride or of borax,—in these respects differing from a solution of gum arabic. On the other hand, it agrees with the latter in that it is thrown down as a transparent jelly by alcohol, and rendered turbid by oxalate of ammonium. The residue on the filter is a slightly turbid, slimy, non-adhesive mucilage, which when dried forms a very coherent mass. It has received the name of *Bassorin*, *Traganthin* or *Adraganthin*, and agrees with the formula $C^{12}H^{20}O^{10}$.

The drug loses by drying about 14 per cent. of water, which it absorbs again on exposure to the air. Pure flake tragacanth incinerated leaves 3 per cent. of ash.

Commerce—Tragacanth is shipped from Constantinople, Smyrna and the Persian Gulf. The annual export of the gum from Smyrna has been recently stated[1] to be 4,500 quintals, value 675,000 Austrian florins (£67,500); and the demand to be always increasing.

Uses—Though tragacanth is devoid of active properties, it is a very useful addition to many medicines. Diffused in water it acts as a demulcent, and is also convenient for the suspension of a heavy powder in a mixture. It is an important ingredient for imparting firmness to lozenges and pill masses.

[1] C. von Scherzer, *Smyrna*, Wien, 1873. 143.

Adulteration—The fine quantities consisting of large distinct pieces are not liable to adulteration, but the small and the inferior kinds are often sophisticated. At Smyrna, tragacanth is mixed with gums termed respectively *Mosul* and *Caramania Gum*. The former appears to be simply very inferior tragacanth; the latter which is sometimes called in the London market *Hog Gum Tragacanth* or *Bassora Gum*,[1] is said to be the exudation of almond and plum trees. It occurs in nodular masses of a waxy lustre and dull brown hue, which immersed in water gradually swell into a voluminous white mass. To render this gum available for adulteration, the lumps are broken into small angular fragments, the size of which is adjusted to the sort of tragacanth with which they are to be mixed. As the Caramania Gum is somewhat dark, it is usual to whiten it by *white lead*, previous to mixing it with *Small Leaf* or *Flake*, or with the *Vermicelli* gum.

By careful examination the fraud is easily detected, angular fragments not being proper to any true tragacanth. The presence of lead may be readily proved by shaking suspected fragments for a moment with very dilute nitric acid, which will dissolve any carbonate present, and afford a solution which may be tested by the ordinary reagents.

RADIX GLYCYRRHIZÆ.

Radix Liquiritiæ; Liquorice Root; F. *Réglisse;* G. *Süssholz, Lakrizwurzel.*

Botanical Origin—*Glycyrrhiza glabra* L., a plant which under several well-marked varieties,[2] is found over an immense extent of the warmer regions of Europe, spreading thence eastward into Central Asia. The root used in medicine is derived from two principal varieties, namely:—

α. typica—Nearly glabrous, leaves glutinous beneath, divisions of the calyx linear-lanceolate often a little longer than the tube, corolla purplish blue, legume glabrous, 3–6 seeded. It is indigenous to Portugal, Spain, Southern Italy, Sicily, Greece, Crimea, the Caucasian Provinces and Northern Persia; and is cultivated in England, France and Germany.

γ. glandulifera (*G. glandulifera* W. K.)—Stems more or less pubescent or roughly glandular, leaves often glandular beneath, legume sparsely or densely echinate-glandular, many-seeded, or short and 2–3 seeded. It occurs in Hungary, Galicia, Central and Southern Russia, Crimea, Asia Minor, Armenia, Siberia, Persia, Turkestan and Afghanistan.

G. glabra L. has long, stout, perennial roots, and erect, herbaceous, annual stems. In var. *α.*, the plant throws out long stolons which run horizontally at some distance below the surface of the ground.

History—Theophrastus[3] in commenting on the taste of different roots (3rd cent. B.C.) instances the sweet Scythian root which grows in the neighbourhood of the lake Mæotis (Sea of Azov), and is good for asthma, dry cough and all pectoral diseases,—an allusion unquestionably to liquorice. Dioscorides[4] who calls the plant γλυκυῤῥίζα, notices its glutinous leaves and purplish flowers, but as he describes the pods to be in balls resembling those of the plane, and the roots to be sub-austere (ὑπόστρυφνοι)

[1] It is sometimes shipped from Bussorah.

[2] We accept those adopted by Boissier in his *Flora Orientalis*, ii. (1872) 202.

[3] *Hist. Plant.* lib. ix. c. 13.

[4] Lib. iii. c. 5.

ı sweet, it is possible he had in view *Glycyrrhiza echinata* L. as . *glabra*.

n writers as Celsus and Scribonius Largus, mention liquorice *dulcis*. Pliny who describes it as a native of Cilicia and Pontus, ı allusion to it growing in Italy.

:ultivation of liquorice in Europe does not date from a very eriod, as we conclude from the absence of the name in early l lists of plants. It is for instance, not enumerated among the ıich Charlemagne ordered (A.D. 812) to be introduced from Italy :ral Europe;[1] nor among the herbs of the convent gardens as l by Walafridus Strabus,[2] abbot of Reichenau, lake of Constance, h century; nor yet in the copious list of herbs contained in the ry of Alfric, archbishop of Canterbury in the 10th century.[3]

ıe other hand, liquorice is described as being cultivated in Italy ı Crescentio[4] of Bologna, who lived in the 13th century. The ›n of the plant in the north of England existed at the close of century, but how much earlier we have not been able to trace.

›rd *Liquiritia* whence is derived the English name *Liquorice* in the 13th century), is a corruption of *Glycyrrhiza*, as shown in itional mediæval form *Gliquiricia*. The Italian *Regolizia* and *l'église* (anciently *Requelice* or *Recolice*) have the same origin.

.vation, and habit of growth—The liquorice plant is culti- England at Mitcham and in Yorkshire, but not on a very : scale. The plants, which require a good deep soil, well by manure, are set in rows, attain a height of 4 to 5 feet and flowers but not seeds. The root is dug up at the beginning of :hen the plant is at least 3 or 4 years old. The latter has then dividing into several aerial stems. Below the crown is a prin- t about 6 inches in length, which divides into several (3 to 5) aight roots, running without much branching, though beset with wiry rootlets, to a depth of 3, 4 or more feet.[5] Besides these d-running roots, the principal root emits horizontal runners or which grow at some distance below the surface and attain a many feet. These runners are furnished with leaf buds and ı stems in their second year.

r portion of the subterraneous part of the plant is carefully he roots proper are washed, trimmed, and assorted, and either h in their entire state, or cut into short lengths and dried, the ayer being sometimes first scraped off. The older runners dis- ›d at Mitcham as "*hard*," are sorted out and sold separately; g, called "*soft*," are reserved for propagation.

'alabria, the singular practice prevails of growing the liquorice ıe wheat in the cornfields.

:ription—Fresh liquorice (English) when washed is externally ht yellowish brown. It is very flexible, easily cut with a knife,

Monumenta Germaniæ historica, 1835) 156.

Patrologiæ Cursus, cxiv. 1122.

t, *Volume of Vocabularies*, 1857. work contains several other early nts.

della Agricoltura, Venet. 1511. 12.

[5] This form of root which reminds one of a whip with three or four lashes and a very short handle, is probably due to the method of propagating adopted at Mitcham, where a short stick or *runner* is planted upright in the ground.

exhibiting a light yellow, juicy, internal substance which consists of a thick bark surrounding a woody column. Both bark and wood are extremely tough, readily tearing into long, fibrous strips. The root has a peculiar earthy odour, and a strong and characteristic sweet taste.

Dried liquorice root is supplied in commerce either with or without the thin brown coat. In the latter state it is known as *peeled* or *decorticated*. The English root, of which the supply is very limited, is usually offered cut into pieces 3 or 4 inches long, and of the thickness of the little finger.

Spanish Liquorice Root, also known as *Tortosa* or *Alicante Liquorice*, is imported in bundles several feet in length, consisting of straight unpeeled roots and runners, varying in thickness from ¼ to 1 inch. The root is tolerably smooth or somewhat transversely cracked and longitudinally wrinkled; that from Tortosa is usually of a good external appearance, that from Alicante sometimes untrimmed, dirty, of very unequal size, showing frequently the knobby crowns of the root. Alicante liquorice root is sometimes shipped in bags or loose.

Russian Liquorice Root, which is much used in England, is we presume derived from *G. glabra* var. *glandulifera*. It is imported from Hamburg in large bales, and is met with both peeled and unpeeled. The pieces are 12 to 18 inches long with a diameter of ¼ of an inch to 1 or even 2 inches. Sometimes very old roots split down the centre and forming channelled pieces as much as 3½ inches wide at the crown end, are to be met with. This liquorice in addition to being sweet has a certain amount of bitterness.

Microscopic Structure—The root exhibits well-marked structural peculiarities. The corky layer is made up of the usual tabular cells; the primary cortical tissue of a few rows of cells. The chief portion of the bark consists of liber or endophlœum, and is built up for the most part of parenchymatous tissue accompanied by elongated fibres of two kinds, partly united into true liber-bundles and partly forming a kind of network, the smaller threads of which deviate considerably from the straight line. Solution of iodine imparts an orange hue to both kinds of bast-bundles and well displays the structural features of the bark.

The woody column of the root exhibits three distinct forms of cell, namely ligneous cells (libriform) with oblique ends; parenchymatous, almost cubic cells; and large pitted vessels. In the Russian root, the size of all the cells is much more considerable than in the Spanish.

Chemical Composition—The root of liquorice contains in addition to sugar and albuminous matter, a peculiar sweet substance named *Glycyrrhizin*, which is precipitated from a strong decoction upon addition of an acid or solution of cream of tartar, or neutral or basic acetate of lead. When washed with dilute alcohol and dried, it is an amorphous yellow powder having a strong bitter-sweet taste and an acid reaction. It forms with hot water a solution which gelatinizes on cooling, does not reduce alkaline tartrate of copper, is not fermentable, and does not rotate the plane of polarization. From the analyses and experiments of Gorup-Besanez (1861), it appears that the most probable formula of glycyrrhizin is $C^{24}H^{36}O^{9}$. By boiling glycyrrhizin with dilute hydrochloric acid, it is resolved into a resinous amorphous bitter substance named *Glycyrretin*,

ıd an uncrystallizable sugar having the characters of glucose. The rmula of glycyrretin has not yet been settled.

Alkalies easily dissolve glycyrrhizin with a brown colour and emis-ıon of a peculiar odour. In the root it perhaps exists combined with mmonia, inasmuch as the aqueous extract evolves that alkali when rarmed with potash. The deep yellow walls of the vessels and prosen-hymatous cells appear to be the chief seat of the glycyrrhizin.

The sugar of liquorice root has not yet been isolated; the aqueous in-fusion of the *dried* root separates protoxide of copper from an alkaline solution of cupric tartrate. Yet the sugar as extracted from the *fresh* root by cold water, does not precipitate alkaline cupric tartrate at all in the cold, and not abundantly even on prolonged boiling.

Asparagin was obtained from the root by Robiquet (1809) and by Plisson (1827). The former also found it to contain *Malic acid.* The presence of starch in abundance is shown by the microscope as well as by testing a decoction of the root with iodine. The outer bark of the root contains a small quantity of tannin.

Commerce—Liquorice root is imported into Great Britain from Germany, Russia and Spain, but there are no data for showing to what extent. France imported in 1872 no less than 4,348,789 kilogrammes (4282 tons), which was more than double the quantity imported the previous year.[1]

Liquorice root is much used in China, and is largely produced in some of the northern provinces. In 1870, 6,954 peculs (= 927,200 ℔.) were shipped from Chefoo, and 1,304 peculs (= 173,866 ℔.) from Ningpo.[2]

Uses—Liquorice root is employed for making extract of liquorice and in some other pharmaceutical preparations. The powdered root is used to impart stiffness to pill masses and to prevent the adhesion of pills. Liquorice has a remarkable power of covering the flavour of nauseous medicines. As a domestic medicine, liquorice root is far more largely used on the Continent than in Great Britain.

SUCCUS GLYCYRRHIZÆ.

Succus Liquiritiæ, Extractum Glycyrrhizæ Italicum; Italian Extract of Liquorice, Spanish Liquorice, Spanish Juice; F. *Jus ou Suc de Réglisse;* G. *Süssholzsaft, Lakriz.*

Botanical Origin—*Glycyrrhiza glabra* L., see preceding article, p. 56).

History—Inspissated liquorice juice was known in the time of Dioscorides, and may be traced in the writings of Oribasius and Marcellus Empiricus in the latter half of the 4th century, and in those of Paulus Ægineta in the 7th. It appears to have been in common use in Europe during the middle ages. In A.D. 1264, "*Liquorice*" is charged in the Wardrobe Accounts of Henry III.;[3] and as the article cost 3*d.* per ℔., or the same price as grains of paradise and one-third that of cinnamon, we are warranted in supposing the *extract* and not the mere

[1] *Documents Statistiques réunis par l'administration des Douanes sur le commerce de France, année 1872*, Paris 1873.

[2] *Reports on Trade at the Treaty Ports in China for* 1870, Shanghai, 1871. 13. 62.

[3] Rogers, *Hist. of Agriculture and Prices*, ii. (1866) 543.

root is intended. Again, in the Patent of Pontage granted by Edward I., A.D. 1305, to aid in repairing London Bridge, permission is given to lay toll on various foreign commodities including *Liquorice*.[1] A political song written in 1436 [2] makes mention of *Liquorice* as a production of Spain, but the plant is not named as an object of cultivation by Herrera the author of a work on Spanish agriculture in 1513.

Saladinus [3] who wrote about the middle of the 15th century, names it among the wares kept by the Italian apothecaries; and it is enumerated in a list of drugs of the city of Frankfort written about the year 1450.[4]

Dorsten [5] in the first half of the 16th century, mentions the liquorice plant as abundant in many parts of Italy, and describes the method of making the *Succus* by crushing and boiling the fresh root. Mattioli [6] states that the juice made into *pastilli* was brought every year from Apulia, and especially from the neighbourhood of Monte Gargano. Extract of liquorice was made at Bamberg in Germany, where the plant is still largely cultivated, as early as 1560.[7]

Manufacture—This is conducted on a large scale in Spain, Southern France, Sicily, Calabria, Austria, Southern Russia (Astracan and Kasan), Greece (Patras) and Asia Minor (Sokia and Nazli, near Smyrna); but the extract with which England is supplied, is almost exclusively the produce of Calabria, Sicily and Spain.

The process of manufacture varies only by reason of the amount of intelligence with which it is performed, and the greater or less perfection of the apparatus employed. As witnessed by one of us (H.) at Rossano in Calabria in May, 1872, it may be thus described from notes made at the time. The factory employs about 60 persons, male and female. The root having been taken from the ground the previous winter, is stacked in the yard around the factory; it is mostly of the thickness of the fingers, with here and there a piece of larger size up to a diameter of nearly 2 inches; some of it is sprouting.

As required, the root is taken within the building and crushed under a heavy millstone to a pulp, water-power being employed. It is then transferred to boilers and boiled with water over a naked fire. The decoction is run off and the residual root pressed in circular bags like those used in the olive-mills. The liquor which is received into cisterns below the floor is then pumped up into copper pans, in which the evaporation is conducted also over the naked fire—even to the very last, care being taken by constant stirring to avoid burning the extract. The extract or *pasta* is removed from the pan while warm, and taken in small quantities to an adjoining apartment where a number of women are employed in rolling it into sticks. It is first weighed into portions, each of which the woman seated at the end of a long table tears with her hands into about a dozen pieces. These are passed to the women sitting next who roll them with their hands into cylindrical sticks, the table on which the rolling is done being of wood, and the *pasta* moistened with oil to prevent its adhesion to the hands. Near the further end of the table are some frames made of marble or metal, clean and bright, on

[1] *Chronicles of London Bridge*, 1827. 155.

[2] Wright, *Political Poems and Songs* (Master of the Rolls series), ii. (1861) 160.

[3] *Compendium Aromatariorum*, Bonon. 1488.

[4] Flückiger, *Die Frankfurter Liste*, Halle, 1873, page 10, No. 204.

[5] *Botanicon*, Francof. 1540. 175.

[6] *Comm. in lib. Diosc.*, Basil. 1574. 485.

[7] Gesner, *Horti Germanici*, Argent. 1561. 237, b

d as to bring the sticks when rolled in them to the proper length ickness. When thus adjusted, they are carefully ranged on a nd a woman then stamps them with the name of the manufacturer. he sticks laid on boards are stacked up in a room to dry.

ome establishments the vacuum pan has been introduced for the tion of the decoction. At the great manufactory of Mr. A. O. at Sokia near Smyrna, all the processes are performed by steam

scription—Liquorice juice of good quality is met with in ical sticks stamped at one end with the maker's name or mark. re of various sizes, but generally not larger than 6 to 7 inches about an inch in diameter. They are black, when new or warm flexible, but breaking when struck, and then displaying a sharp-racture, and shining conchoidal surface on which a few air-bubbles eptible; thin splinters are translucent. The extract has a special nd dissolves in the mouth with a peculiar strong sweet taste. plete drying, it loses from 11 to 17 per cent. of water.

eral varieties of Stick Liquorice are met with in English ce, and command widely different prices. The most famous is *izzi Juice*, manufactured at Corigliano, a small town of Calabria gulf of Taranto, at an establishment belonging to the sons of Don Gaetani, duke of Laurenzano and prince of Piedimonte d'Alife, herited the manufacture from his father-in-law, the Cavaliere ico Solazzi Castriota. The Solazzi Juice destined for the English is usually shipped at Naples; it has for many years been wholly ed to two firms in London, and in quantity not always equal to nand. Of the other varieties we may mention *Barracco*, manu-l at the establishment of Messieurs Barracco at Cotrone on the coast of Calabria; *Corigliano* produced at a factory at Corigliano, ng to Baron Compagna. The sticks stamped *Pignatelli* are from ks of Vincenzo Pignatelli, prince of Strongoli, at Torre Cerchiara, 00 to 400 workmen are employed.

juice is also imported in a block form, having while warm and n allowed to run into the wooden case in which it is exported. ice, which is known as *Liquorice Paste*, is largely imported from nd Asia Minor, but on account of a certain bitterness is unsuited as a sweetmeat.

mical Composition—Hard extract of liquorice such as that cribed, is essentially different in composition and properties from tract of Liquorice (*Extractum Glycyrrhizæ*) of the *British copœia*.[1] The latter is a soft, hygroscopic substance, entirely in cold water, whereas the so-called *Spanish Juice* when treated ld water leaves a large residue undissolved.

as been sometimes supposed that the presence of this residue s adulteration but such is far from being the fact, as was ively shown by the researches of a French Commission appointed tigate the process recommended by Delondre.[2] This commission d liquorice root to the successive action of cold water, boiling nd lastly of steam. By the first menstruum 15 per cent., and by

[1] by treating the crushed root with r.

[2] *Journ. de Pharm.* xxx. (1856) 428; an abstract by Redwood in *Pharm. Journ.* xvi. (1857) 403.

the second an additional 7½ per cent., were obtained of a hygroscopic extract much more soluble than commercial liquorice, and totally unsuitable for being moulded into sticks. The residue having been then exhausted by steam, 16 per cent. was obtained of an extract differing entirely from those of the previous operations. It was a dry friable substance, cracking and falling to pieces in the drying stove, having a sweet taste without acridity, not readily dissolving in the mouth, and very imperfectly soluble in cold water. This then was the substance required to give firmness to the more soluble matter, and to render possible the preparation of an extract possessing that degree of solubility and hardness which would render it an agreeable sweetmeat, as well as a permanent and stable commodity. In fact, by treating the root at once with steam according to Delondre's process, the experimenters obtained 42 to 45 per cent. of extract having all the qualities desired in good Italian or Spanish Juice.

When the latter substance is suspended in water undisturbed, the soluble matter may be dissolved out, the stick still retaining its original form. Glycyrrhizin which is but slightly soluble in cold water, remains to some extent in the residue, and by an alkaline solution may be afterwards extracted together with colouring matter and probably also pectin. The proportion of soluble matter which the best varieties of liquorice juice yield to cold water, varies from about 60 to 70 per cent. A sample of Solazzi Juice recently examined by one of us, lost 8·4 per cent. when dried at 100° C.; it was then exhausted by 60 times its weight of cold water used in successive quantities, by which means 66·8 per cent. of soluble matter were removed. The residue consisted of minute starch granules, fragments of the root, and colouring matter partially soluble in ammonia. Small shreds of copper were also visible to the naked eye. The dried juice yielded 6·3 per cent. of ash.

Corigliano liquorice treated in the same manner gave 71·2 per cent. of extract soluble in cold water; Barracco liquorice 64·9.

The small liquorice lozenges known as *Pontefract Cakes* (Dunhill's), not previously dried, gave 71 per cent. of matter soluble in cold water.

Commerce—The value of the imports of Liquorice into the United Kingdom has been for the last five years as follows:—

1868	1869	1870	1871	1872
£89,482	£83,832	£70,165	£55,120	£75,991

The last named sum represents a quantity of 28,000 cwt., of which 11,170 cwt. were furnished by Italy, and the remainder by Turkey, France, Spain, and other countries.

The total exports of Liquorice Paste from Smyrna were estimated in 1872 as 1,200 to 1,400 tons (24,000 to 28,000 cwt.) per annum.

Uses—Stick liquorice is sucked as a remedy for coughs, and by children as a sweetmeat. It is also used in lozenges, and in some pharmacopœias is admitted as the raw material from which to prepare soft extract of liquorice.

The block liquorice, of which a large quantity is imported, is chiefly used in the manufacture of tobacco for smoking and chewing.

OLEUM ARACHIS.

nut oil, Earth-nut oil, Arachis oil; F. *Huile d'Arachide ou de Pistache de terre;* G. *Erdnussöl.*

anical Origin—*Arachis hypogæa* L., a diffuse herbaceous annual .ving stems a foot or two long, and solitary axillary flowers with emely long filiform calyx-tube. After the flower withers, the pporting the ovary becomes elongated as a rigid stalk, which own to the ground and forces into it the young pod, which its seeds some inches below the surface. The ripe pod is oblong, cal, about an inch in length, indehiscent, reticulated, and contains wo irregularly ovoid seeds.

plant is cultivated for the sake of its nutritious oily seeds in all and subtropical countries, but especially on the west coast of It is unknown in the wild state. De Candolle[1] regards it as a of Brazil, to which region the other species of the genus ely belong. But the opinion of one of us[2] is strongly in favour lant being indigenous to Tropical Africa.

tory—The first writer to notice the Ground Nut appears to be es,[3] who describes it as a nameless subterraneous fruit, found e river Marañon and held in great esteem by both Indians and ls. Some account of it and a figure were given in the following by Marcgraf,[4] who calls it by its Brazilian name of *Mundubi.*

only in very recent times that the value of the Ground Nut recognized in Europe. Jaubert, a French colonist at Gorée near erde, first suggested about 1840 its importation as an oil-seed rseilles, where it now constitutes one of the most important of trade.[5]

cription—The fat oil of *Arachis* as obtained by pressure without almost colourless, of an agreeable faint odour and a bland taste ng that of olive oil. An inferior oil is obtained by warming ls before pressing them. The best oil has a sp. gr. of about t becomes turbid at 3° C., concretes at −3° to −4°, and hardens On exposure to air it is but slowly altered, being one of the ng oils. At length it thickens considerably, and assumes even l vessels a disagreeable rancid smell and taste.

mical Composition—The oil consists of the glycerides of four fatty acids. The common *Oleic Acid*, $C^{18}H^{34}O^2$, that is to say rin compound, is the chief constituent of Arachis oil. *Hypogæic* $^{5}H^{30}O$,[2] has been pointed out by *Gössmann and Scheven* (1854) r acid, whereas it is thought by other chemists to agree with he fatty acids obtained from whale oil. The melting point of from Arachis oil is 34—35° C. The third acid afforded by the linary *Palmitic Acid*, $C^{16}H^{32}O^2$, with a fusing point of 62° C.

phie *Botanique*, ii. (1855) 963.
ger, *Ueber die Erdnuss*,—*Archiv.* acie, 190. (1869) 70—84.
as que se traen de nuestras Indias , Sevilla 1569, part 2.
lerum. *Nat. Bras.*, 1648, 37.

[5] Duval, *Colonies et politique coloniale de la France*, 1864. 101.—Mavidal, *Le Sénégal, son état present, son avenir*, Paris 1863, 171. —Carrère et Holle, *La Sénégambie Française*, 1855, 84. — Poiteau, in *Annales des Sciences nat., Botanique*, xix. (1853) 268.

Arachic Acid, $C^{20}H^{40}O^2$, the fourth constituent, has also been met with among the fatty acids of butter and olive oil, and, according to Oudemans (1866), in the tallow of *Nephelium lappaceum* L., an Indian plant of the order *Sapindaceæ*.

When ground-nut oil is treated with hyponitric acid, which may be most conveniently evolved by heating nitric acid with a little starch, a solid mass is obtained, which yields by crystallization from alcohol *Elaïdic* and *Gœidinic* acids, the former isomeric with oleic, the latter with hypogæic acid.

Production and Commerce—The pods, or the seeds removed from them, are exported on an immense and ever increasing scale from the West Coast of Africa. From this region, not less than 66 millions of kilogrammes, value 26 millions of francs (£1,040,000), were imported in 1867, almost exclusively into Marseilles.

The oil is exported from India where the ground-nut is also cultivated, though not on so large a scale as in Western Africa. In Europe it is manufactured chiefly at Marseilles, London, Hamburg and Berlin. The yield of the seeds varies from 42 to nearly 50 per cent. The softness of the seeds greatly facilitates their exhaustion, whether by mechanical power or by the action of bisulphide of carbon or other solvent.

Uses—Good arachis oil may be employed in pharmacy in the same way as olive oil, for which it is a valuable substitute, though more prone to rancidity. It has been introduced into the *Pharmacopœia of India*, and is generally used instead of olive oil in the Indian Government establishments. Its largest application is for industrial purposes, especially in soap-making.

RADIX ABRI.

Indian Liquorice ; F. *Liane à réglisse, Réglisse d'Amérique.*

Botanical Origin—*Abrus precatorius* L., a twining woody shrub indigenous to India, but now found in all tropical countries.

History—The plant is mentioned in the Sanskrit medical writings of Susruta, whence we may infer that it has long been employed in India. Its resemblance to liquorice was remarked by Sloane (1700), who called it *Phaseolus glycyrrhites*. As a substitute for liquorice, the root has been often employed by residents in the tropical countries of both hemispheres. It was introduced into the *Bengal Pharmacopœia* of 18[illegible] and into the *Pharmacopœia of India* of 1868.

The seeds, of the size of a small pea, well known for their polish and beautiful black and red colours, have given their name of *Retti* to a weight (= $2\frac{3}{16}$ grains) used by Hindu jewellers and druggists.

Description—The root is long, woody, tortuous and branching. The stoutest piece in our possession is as thick as a man's finger, but most of it is much more slender. The cortical layer is extremely thin and of a light brown or almost reddish hue. The woody part breaks with a short fibrous fracture exhibiting a light yellow interior. The root has a peculiar, disagreeable odour, and a bitterish acrid flavour leaving a faintly sweet after-taste. When cut into short lengths it has a slight resemblance to liquorice, but may easily be distinguished by means of the microscope.

Moodeen Sheriff[1] who says he has often examined the root of ›th fresh and dried, remarks that it is far from abounding in is generally considered;—that it does not possess any sweetness ıtil it attains a certain size, and that even then its sweet taste is ıys well marked. As it is often mixed in the Indian bazaars ıe liquorice, he thinks the latter may have sometimes been ı for it.

roscopic Structure—On a transverse section the bark some layers of cork cells, loaded with brown colouring matter ı, within the middle zone of the bark, a comparatively thick sclerenchymatous tissue. Strong liber fibres are scattered the interior of the cortical tissue, but are not distributed so as wedge-shaped rays as met with in liquorice. In the latter the ıyme (thick-walled cells) is wanting. These differences are : to distinguish the two roots.

nical Composition—The concentrated aqueous infusion of the Abrus has a dark brown colour and a somewhat acrid taste nied by a faint sweetness. When it is mixed with an alkaline of tartrate of copper, red cuprous oxide is deposited after a ıe: hence we may infer that the root contains sugar. One drop chloric or other mineral acid mixed with the infusion produces bundant flocculent precipitate, which is soluble in alcohol. If ›ion of Abrus root is mixed with a very little acetic acid, an t precipitate is likewise obtained, but is dissolved by an excess. aviour is similar to that of glycyrrhizin (see p. 158).

ɛlius observed so long ago as 1827, that the *leaves* of Abrus ı sweet principle similar to that of liquorice.

ɛ—The root has been used in the place of liquorice, for which ur opinion a very bad substitute.

SETÆ MUCUNÆ.

ı pubes vel setæ; Cowhage, Cow-itch[2]: F. *Pois à gratter, Pois pouillieux*; G. *Juckborsten.*

ınical Origin—*Mucuna pruriens* DC. (*Dolichos pruriens* L., *ıum pruriens* Pers., *Mucuna prurita* Hook.), a lofty climbing th large, dark purple papilionaceous flowers, and downy legumes nd shape not unlike those of a sweet pea, common throughout ıcal regions of both Africa, India and America.

ory—The earliest notice we have found of this plant is that of ›n, who in his *Theater of Plants* published in 1640, names it *lus siliquâ hirsutâ*, the Hairy Kidney-Beane called in Zurrate where it groweth, *Couhage*." It was subsequently described by 36), who saw the plant raised from West Indian seeds, in the ›f the Hatton family in Holborn.[3] Rheede figured it in the

ment to the Pharmacopœia of India, 569, 17.—The author has kindly cimens of the root. We are also for authentic samples to Mr. ›f the Royal Botanical Garden, d to Mr. Prestoe of the Botanical inidad. The last named gentleman remarks—"I do not find any liquorice property in the root, even fresh, but it is very strong in the green leaves."

[2] These names and the following are also applied to the entire pods, or even to the plant.

[3] *Hist. Plant.* i. 887.

Hortus Malabaricus,[1] and it was also known to Rumphius and the other older botanists.

The employment of cowhage as a vermifuge originated in the West Indies, and is quite unknown in the East. In England the drug began to attract attention in the latter part of the last century, when it was strongly recommended by Bancroft in his *Natural History of Guiana* (1769), and by Chamberlaine, a surgeon of London, who published an essay[2] descriptive of its effects which went through many editions. It was introduced into the Edinburgh Pharmacopœia of 1783, and into the London Pharmacopœia of 1809. At the present day it has been almost discarded from European medicine, but has been allowed a place in the *Pharmacopœia of India* (1868).

The name *Cowhage* is Hindustani, and in the modern way is written *Kiwach;* the corruption into *Cow-itch* is absurd. *Mucuna* is the Brazilian name of another species mentioned in 1648 by Marcgraf.[3]

Description—The pods are 2 to 4 inches long, about $\frac{4}{10}$ of an inch wide, and contain 4 to 6 seeds; they are slightly compressed and of a dark blackish brown. Each valve is furnished with a prominent rib running from the apex nearly to the base, and is densely covered with rigid, pointed, brown hairs measuring about $\frac{1}{10}$ of an inch in length. The hairs are perfectly straight and easily detached from the valves, or of the epidermis of which they rise. If incautiously touched, they enter the skin and occasion an intolerable itching.

Microscopic Structure—Under the microscope the hairs are seen to consist of a single, sharply pointed, conical cell, about $\frac{1}{40}$ of an inch in diameter at the base, with uniform brownish walls 5 mkm. thick which towards the apex are slightly barbed. Occasionally a hair shows one or two transverse walls. Most of the hairs contain only air; others show a little granular matter which acquires a greenish hue on addition of alcoholic solution of perchloride of iron. If moistened with chromic acid, no structural peculiarity is revealed that calls for remark. The walls however are somewhat separated into indistinct layers, the presence of which is confirmed by the refractive power displayed by the hairs in polarized light.

Chemical Composition—The hairs when treated with sulphuric acid and iodine assume a dark brown colour. Boiling solution of potash does not considerably swell or alter them. They are completely decolorized by concentrated nitric acid.

Uses—Cowhage is administered for the expulsion of intestinal worms especially *Ascaris lumbricoides* and *A. vermicularis*, which it effects by reason of its mechanical structure. It is given mixed with syrup or honey in the form of an electuary.

The root and seeds are reputed medicinal by the natives of some part of India. The pods when young and tender may be cooked and eaten.

[1] Tom. viii. tab. 35, sub. nom. *Nāi Curana.*

[2] *On the efficacy of Stizolobium or Cowhage*, Lond. 2nd ed., 1784.

[3] *Hist. Nat. Brasil.* 18.

SEMEN PHYSOSTIGMATIS.

'alabarica, Faba Physostigmatis; Calabar Bean, Ordeal Bean of Old bar, Eseré Nut, Chop-nut; F. *Fève de Calabar;* G. *Calabarbohne.*

tanical Origin—*Physostigma venenosum* Balfour, a perennial esembling the common Scarlet Runner (*Phaseolus multiflorus*, Lam.) gardens, but having a woody stem often an inch or two thick, ıg to a height of 50 feet or more. It grows near the mouths of ger and the Old Calabar River in the Gulf of Guinea.

: imported seeds germinate freely, but the plant though it thrives ısly in a hothouse has not yet, we believe, flowered in Europe. already been introduced into India and Brazil. In the latter y Dr. Peckolt, late of Cantagallo, has raised plants which have ned abundantly, producing racemes of about 30 flowers each, ıt from the axils of the ternate leaves.

: flower, which is fully an inch across and of a purplish colour, has m of *Phaseolus*, but is distinguished from that genus by two characters, namely that it has the style developed beyond the backwards as a broad, flat, hooked appendage,[1] and the seeds half nded by a deeply grooved hilum.

story—The pagan tribes of Tropical Western Africa compel per- ccused of witchcraft to undergo the ordeal of swallowing some ɔle poison. One of the substances employed in this horrid is the seed under notice, which is administered in substance or form of emulsion, or even as a clyster. It was first made known land by Dr. W. F. Daniell about the year 1840, and subsequently l to in a paper read by him before the Ethnological Society in The highly poisonous effects of the bean were observed in 1855 istison[3] in his own person, and in 1858 by Sharpey, who admi- d it to frogs.

'ore the seed became an object of commerce, it was regarded by tives with some mystery and was reluctantly parted with to ans. It was moreover customary in Old Calabar to destroy the whenever found, a few only being reserved to supply seeds for l purposes, and of these seeds the store was kept in the custody native chief. In 1859, the Rev. W. C. Thomson, a missionary West Coast of Africa, forwarded the plant to Professor Balfour ıburgh who described it as the type of a new genus.[4]

ser of Edinburgh (about 1863 or earlier) discovered the specific of the seed in contracting the pupil, when the alcoholic extract is to the eye. These myotic effects, counteracting those of atropine oscyamine, were further examined by G. Harley, A. von Gräfe, son, Hulke, Workman, Woolcott, Czermak, Wells and many xperimenters on mammals or birds. The action of the poison when

name of the genus, from φύσα, a was formed under the notion that ndage is *hollow*, which is not the

b. *New Phil. Journ.*, xl. (1846) 313.

[3] *Edinb. Journ. of Med. Science*, xx. (1855) 193; *Pharm. Journ.*, xiv. (1855) 470.

[4] *Trans. Roy. Soc. of Edinb.* xxii. (1861) 305. t. 16–17: see also Baillon, *Hist. des Plantes*, ii. 206. figg. 153–155.

taken internally was found rapidly to affect the cardiac contractions and finally to paralyze the heart.

Description—The fruit of *Physostigma* is a dehiscent, oblong legume about 7 inches in length, containing 2 or 3 seeds. The latter, commonly known as *Calabar Beans*, are 1 to $1\frac{3}{8}$ inches long, about $\frac{6}{8}$ of an inch broad, and $\frac{4}{8}$ to $\frac{5}{8}$ of an inch in thickness, weighing on an average of twenty seeds, 67 grains each.

They have an oblong, subreniform outline, one side being straight or but slightly incurved, the other boldly arched. The latter is marked by a broad furrow, $\frac{1}{8}$ of an inch wide, bordered with raised edges, and running from the micropyle, which is a small funnel-shaped depression, quite round the opposite end of the seed. In the middle of this remarkable furrow the raphe is seen as a long raised suture running from end to end. The surface of the seed is somewhat rough but has a dull polish; it is of a deep chocolate brown, passing into a lighter tint on the ridges bordering the furrow. The latter is black, dull, and finely rugose.

When the seed is broken the cotyledons are found adherent to the testa, with a large cavity between them. The air thus included causes the seeds to float on water, but they sink immediately when broken. After digestion for some hours in warm water, the testa having been previously cracked, the whole seed softens and swells so that its structure may be easily studied. Each cotyledon is then seen to be marked on the hilum-side by a long shallow furrow, at one end of which, just below the micropyle, lies the plumule and radicle. A dark brown inner membrane constituting part of the testa, surrounds the cotyledons.

The seeds have scarcely any taste, or not more than an ordinary bean; nor in the dry state have they any odour. After being boiled, or when their alcoholic tincture is evaporated, an odour suggesting cantharides is developed.

Microscopic Structure—The cotyledons are built up of large globular or ovoid cells, those of the outermost layer being smaller and of rather cubic form. This parenchyme is loaded with starch granules, frequently as much as 50 mkm. in diameter. Their interior part is less distinctly stratified than the outer; the hollow centre radiates in various directions around the axis of the ovate granule. Polarized light does not show a cross as in other more globular starch granules, but two elliptic curves approaching one another near the axis of the granule. Similar starch granules are commonly met with in the seeds of *Leguminosæ*.

In the Calabar seeds the starch is accompanied by numerous particles of albuminous matter becoming distinctly perceptible by addition of iodine, which imparts to them an orange coloration.

The shell of the seed is built up of four different layers; the prevailing layer consists of very long, simply cylindrical cells, densely packed so as to form only one radial row. Tison [1] has endeavoured to ascertain in what anatomical structure of the seed the active principle is lodged; and he has arrived at the conclusion that its seat is the granular protoplasmic particles, which alone acquire an orange tint by the action of weak caustic alkalis.

[1] *Histoire de la Fève de Calabar*, Paris, 1873. 38.

nical Composition—Jobst and Hesse[1] proved in 1863 that
›nous nature of Calabar bean depends upon an alkaloid, to which
'e the name *Physostigmine*. It is obtained by the method
' adopted for extracting analogous substances, that is, by preci-
one of its salts from an aqueous solution by bicarbonate of
and dissolving out the base with ether or benzol. As extracted
: chemists, physostigmine is an amorphous mass of decidedly
reaction, soluble in much water and in acids. On exposure to
the solution soon becomes red, or sometimes intensely blue, a
ecomposition of the alkaloid taking place. The red coloration
n be observed in the aqueous infusion of a few cotyledons. It
rs by sulphuretted hydrogen or sulphurous acid, but returns if
lucing agents are allowed to evaporate.

e[2] ascertained (1867) that physostigmine consists of $C^{30}H^{21}N^3O^4$;
obtained it perfectly colourless and tasteless, softening at
'using at 45° C., but not supporting a heat of 100° C., without
sition, which is manifested by a red coloration.

365, Vée and Leven[3] by treating the powdered unpeeled seed in
ıe same way, prepared an alkaloid which they called *Eserine*.
; from Hesse's physostigmine in that it forms colourless, rhom-
ıbular crystals[4] of a bitter taste, melting at 90° C. It dissolves
ether, alcohol, or chloroform, but very sparingly in water. The
ed solution is alkaline, and reddens by exposure to the air. Eserine
, in acids and neutralizes them, forming soluble (crystalline ?)
he sulphate dissolved in 200 parts of water affords a white pre-
with tannic acid or iodohydrargyrate of potassium, brown with
d iodide of potassium and yellow with chloride of gold. The last-
recipitate rapidly turns brown, the solution acquiring a red tint.
assumed by some writers, as Tison,[5] that eserine is only the
n of physostigmine; but at present we feel hardly warranted in
g the identity of the two substances.

; the cotyledons *per se*, cold water extracts mucilage, precipitable
al acetate of lead. The watery infusion contains also albumin,
ay be coagulated by heat or by alcohol. The infusion is colour-
, not redden litmus, nor does it contain sugar in appreciable pro-
a few drops of solution of potash cause it to assume an orange
An infusion of the shell of the seed is already of this colour, but
s intensified by caustic alkali.

'otyledons yield to boiling ether ½ to ⅓ per cent. of fatty oil, and
austion by ether and alcohol, afford to cold water 12 per cent.
inous and mucilaginous constituents. The proportion of starch
: to Teich[6] amounts to 48 per cent., the albuminous matter to

[1] *Annalen der Chem. u. Pharm.*
115.
41 (1867) 82; *Chem. News*, 22
', 149.
[3] *Rendus*, lx. (1865) 1194.
layer of New York obtained the
' Calabar bean as an almost
nass capable of forming crystal-
(*American Journ. of Pharm.*,
173.) Hesse prepared the iodo-
of physostigmine in a crystal-

chap. 2.

[6] *Chemische Untersuchung der Calabarbohne.* — Inauguralschrift, St. Petersburg 1867.—Teich exhausted the kernels successively with ether, alcohol, and cold water, and then transformed the starch into sugar by means of hydrochloric acid. The proportion of sugar was then calculated according to the amount of protoxide of copper, which it separated from an alkaline solution of tartrate of copper. We calculate the albuminous matters with reference to *Teich's* analysis, which proved the kernels to contain 3·65 per cent. of nitrogen.

23 per cent. The entire seed furnishes 3 per cent. of ash, chiefly phosphate of potash. These constituents do not widely differ in proportion from those found in the common bean, which yields 23 to 25 per cent. of albuminous matters and 32 to 38 per cent. of starch, besides 1 to 3 per cent. of oil.

The shells of Calabar bean are stated by Fraser to be by no means devoid of active principle.

Vée asserts that if to a solution of eserine, a little potash, lime or carbonate of sodium be added, there is developed a red colour which rapidly increases in intensity. This colour is transient, passing into yellow, green and blue. If chloroform is shaken with such coloured solution, it takes up the colour; ether on the other hand remains uncoloured.

Uses—Calabar bean has been hitherto chiefly employed as an ophthalmic medicine, for the purpose of contracting the pupil. It has however been occasionally administered in tetanus and in neuralgic, rheumatic, and other diseases.

Adulteration—Other seeds are sometimes fraudulently mixed with Calabar beans. We have noticed in particular those of a *Mucuna* and of the Oil Palm, *Elæis Guineensis* L. The slightest examination suffices for their detection.

KINO.

Kino, Gum Kino, East Indian Kino; F. and G. *Kino.*

Botanical Origin—*Pterocarpus Marsupium* Roxb., a handsome tree 40 to 80 feet high, frequent in many parts of the Indian Peninsula and also in Ceylon, and affording a valuable timber. In the Government forests of the Madras Presidency, it is one of the *reserved trees*, the felling of which is placed under restrictions.

Pt. indicus Willd., a tree of Southern India, the Malayan Peninsula and the Indian and Philippine Islands, is capable of yielding kino and is the source of the small supplies of that drug that were formerly shipped from Moulmein.

Several other plants afford substances bearing the name of *Kino*, which will be noticed at the conclusion of the present article.

History—The introduction of kino into European medicine is due to Fothergill, an eminent physician and patron of economic botany of the last century. The drug which Fothergill examined, was brought from the river Gambia in West Africa as a rare sort of Dragon's Blood, and was described by him in 1757[1] under the name of *Gummi rubrum astringens Gambiense.* It had been noticed at least twenty years before as a production of the Gambia, by Moore, factor to the Royal African Company, who says that the tree yielding it, is called in the Mandingo language *Kano.*[2] Specimens of this tree were sent to England in 1805 by the celebrated traveller Mungo Park, and recognized some years later as identical with the *Pterocarpus erinaceus* of Poiret.

It seems probable that African kino continued to reach England for some years, for we find "*Gummi rubrum astringens*" regularly valued in the stock of a London druggist[3] from 1776 to 1792.

[1] *Medical Observations and Inquiries*, i. (1757) 358.

[2] *Travels into the Inland Parts of Africa*, by Francis Moore, Lond. 1737. pp. 160. 209. 267.

[3] J. Gurney Bevan, Plough Court, Lombard Street.—The drug was priced in 1792 as having cost 16s.,—and in 1790-92, 21s. per lb.

Duncan in the *Edinburgh Dispensatory* of 1803, while asserting that ino *is brought to us from Africa*," admits that some, not distinguishable om it, is imported from Jamaica. In a later edition of the same work 811), he says that the African drug is no longer to be met with, and ludes to its place being supplied by other kinds, as that of Jamaica, at imported by the East India Company, and that of New South Wales rived from *Eucalyptus resinifera*. It will thus be seen that at the mmencement of the present century several substances, produced in idely distant regions, bore the name of *Kino*. That however which was rincipally used in the place of the old African drug, was *East Indian* ino, the botanical origin of which was shown by Wight and by Royle[1] 1844–46) to be *Pterocarpus Marsupium* Roxb.,—a tree which, curiously ough, is closely allied to the kino tree of Tropical Africa.

This is the drug which is recognized as legitimate kino in all the rincipal pharmacopœias of Europe. It appears to have been first prered for the European market in the early part of the present century, a a plantation of the East India Company called Anjarakandy, a few iles from Tellicherry on the Malabar Coast; but as we learn from our iend Dr. Cleghorn, it was not grown there but on the ghats a short istance inland.

Extraction—Kino is the juice of the tree, dried without artificial eat.[2] As it exudes, it has the appearance of red currant jelly, but ardens in a few hours after exposure to the air. In the Government rests of the Malabar Coast whence the supplies are obtained, permison to collect the drug is granted on payment of a small fee, and on e understanding that the tapping is performed skilfully and without mage to the timber. The method pursued is this:—A perpendicular cision with lateral ones leading into it, is made in the trunk, at the ot of which is placed a vessel to receive the outflowing juice. This ice soon thickens, and when sufficiently dried by exposure to the sun d air, is packed into wooden boxes for exportation.

Description—Malabar kino[3] consists of dark, blackish-red, angular gments rarely larger than a pea, easily splitting into still smaller eces which are seen to be perfectly transparent, of a bright garnet e, and amorphous under the microscope. In cold water they sink, but rtially dissolve by agitation forming a solution of very astringent taste, d a pale flocky residue. The latter is taken up when the liquid is ade to boil, and deposited on cooling in a more voluminous form. ino dissolves almost entirely in spirit of wine (·838) affording a dark ddish solution, acid to litmus paper, which by long keeping sometimes sumes a gelatinous condition. It is readily soluble in solution of astic alkali, and to a large extent in a saturated solution of sugar.

Chemical Composition—Cold water forms with kino a reddish lution, which is at first not altered if a fragment of ferrous sulphate is lded. But a violet colour is produced as soon as the liquid is cautiously utralized. This can be done by diluting it with common water (coning bicarbonate of calcium) or by adding a drop of solution of slightly

[1] *Pharm. Journ.* v. (1846) 495.

[2] Cleghorn, *Forests and Gardens of South ia*, 1861. 13.—also from information mmunicated by him orally.

[3] Our sample obtained from *Pt. Marsupium* Roxb. on the Sigur Ghat, Feb. 1868, was kindly transmitted to us by Mr. McIvor of Ootacamund.—We find it to agree with commercial East Indian Kino.

alkaline acetate of potassium. Yet the fact of kino developing an intense violet colour in presence of a protosalt of iron, may most evidently be shown by shaking it with water, and iron reduced by hydrogen. The filtered liquid is of a brilliant violet and may be evaporated at 100° without turning green; the dried residue even again forms a violet solution with water. By long keeping the violet liquid gelatinizes. It is decolorized by acids, and turns red on addition of an alkali, whether caustic or bicarbonated. Catechu, as well as crystallized catechin, show the same behaviour, but these solutions quickly turn green on exposure to air.

Solutions of acids, of metallic or earthy salts, or of alkaline chromates produce copious precipitates in an aqueous solution of kino. Ferric chloride forms a dirty green precipitate, and is at the same time reduced to a ferrous salt. Dilute mineral acids or alkalies do not occasion any decided change of colour, but the former give rise to light brownish-red precipitates of *Kino-tannic Acid.* By boiling for some time an aqueous solution of kino-tannic acid, a red precipitate, *Kino-red*, is separated.

Kino in its general behaviour is closely allied to Pegu catechu and yields by similar treatment the same products, that is to say, it affords *Pyrocatechin* when submitted to dry distillation, and *Protocatechuic Acid* together with *Phloroglucin* when melted with caustic soda or potash.

Yet in catechu the tannic acid is accompanied by a considerable amount of catechin, which may be removed directly by exhaustion with ether. Kino, on the other hand, yields to ether only a minute percentage of a substance, whose scaly crystals display under the microscope the character of *Pyrocatechin,* rather than that of catechin, which crystallizes in prisms. The crystals extracted from kino dissolve freely in cold water, which is not the case with catechin, and this solution assumes a fine green if a very dilute solution of ferric chloride is added, and turns red on addition of an alkali. This is the behaviour of catechin as well as of pyrocatechin; but the difference in solubility speaks in favour of the crystals afforded by kino being pyrocatechin rather than catechin.

Pyrocatechin having been met with in the fresh leaves of the Virginian Creeper (*Ampelopsis hederacea* Mich.), we thought it must also occur in the mother-plant of kino, but this does not prove to be the case, no indication of its presence being perceptible either in the fresh bark or wood.[1] Commercial kino yielded us 1·3 per cent. of ash.

Commerce—The quantity of true kino collected in the Madras forests is comparatively small, probably not exceeding a ton or two annually. The drug is often shipped from Cochin.

Uses—Kino is administered as an astringent. It is said to be used in the manufacture of wines, and it might be employed if cheap enough in tanning and dyeing.

[1] We have to thank Mr. Broughton of the Cinchona Plantations, Ootacamund, for determining this point. In the bark almost saturated with fresh liquid kino, he utterly failed to obtain any indication of pyrocatechin by the tests which he found to render it easily evident in dry kino.

Other sorts of Kino.

1. ***Butea Kino, Butea Gum, Bengal Kino, Palas or Pulas Kino,*** ***m of the Palas or Dhak Tree.***

This is an exudation from *Butea frondosa* Roxb. (*Leguminosæ*), a tree India well known under the name of *Palas* or *Dhak*, and conspicuous its splendid, large, orange, papilionaceous flowers. According to Roxrgh it flows during the hot season from natural fissures or from wounds de in the bark, as a red juice which soon hardens into a ruby-loured, brittle, astringent gum.

Authentic specimens of this kino have been placed at our disposal Mr. Moodeen Sheriff of Madras and by Dr. J. Newton of Bellary. at received from the first-named gentleman consists of flattish, angular gments (the largest about ½ an inch across) and small drops or tears a very dark, ruby-coloured gum, which when held to the light is seen be perfectly transparent. The flat pieces have been mostly dried on aves, an impression of the veins of which, they retain on one side, while e other is smooth and shining. The substance has a pure astringent ste but no odour. It yielded us 1·8 per cent. of ash and contained 5 per cent. of water. Ether removes from it a small quantity of *rocatechin*. Boiling alcohol dissolves this kino to the extent of 46 per nt.; the solution which is but little coloured, produces an abundant eyish-green precipitate with perchloride of iron, and a white one with etate of lead. It may be hence inferred that a tannic acid, probably no-tannic acid, constitutes about half the weight of the drug, the mainder of which is formed of a soluble mucilaginous substance which e have not isolated in a state of purity. By submitting the Butea no of Mr. Moodeen Sheriff to dry distillation we obtained pyrocatechin.

The sample from Dr. Newton is wholly in transparent drops and alactitic pieces, considerably paler than that just described but of the me beautiful ruby tint. The fragments dissolve freely and almost mpletely in cold water, the solution being neutral and exhibiting the me reactions as the former sample.

Butea kino, which in India is used in the place of Malabar kino, was ng confounded with the latter by European pharmacologists, though e Indian names of the two substances are quite different. It is not tained exclusively from *B. frondosa* Roxb., the allied *B. superba* Roxb. d *B. parviflora* Roxb. affording a similar exudation.

2. ***African or Gambia Kino***—Of this substance we have a specimen llected by Daniell[1] in the very locality whence it was obtained by loore in 1733 (see p. 170), and by Park at the commencement of the esent century. The tree yielding it, which still bears the Mandingo ame *Kano*, and grows to a height of 40 to 50 feet, is *Pterocarpus erinaeus* Poiret, a native of Tropical Western Africa from Senegambia to ngola. The juice exudes naturally from crevices in the bark, but much ore plentifully by incisions; it soon coagulates, becoming deep blood-d and remarkably brittle. That in our possession is in very small, hining, angular fragments, which in a proper light appear transparent d of a deep ruby colour. In solubility and chemical characters, we can

[1] See his paper *On the Kino Tree of West Africa*, *Pharm. Journ.* xiv. (1855) 55.

trace no difference between it and the kino of the allied *Pt. Marsupium* Roxb. This kino does not now find its way to England as a regular article of trade. From the statement of Welwitsch, it appears that the Portuguese of Angola employ it under the name of *Sangue de Drago*.[1]

3. ***Australian, Botany Bay, or Eucalyptus Kino.***—For some years past, the London drug market has been supplied with considerable quantities of kino from Australia; in fact at one period this kino was the only sort to be purchased.

As it is the produce of numerous species of *Eucalyptus*, it is not surprising that it presents considerable diversity of appearance. The better qualities closely agree with Pterocarpus kino. They are in dark reddish brown masses or grains, which when in thin fragments are seen to be transparent, of a garnet red hue and quite amorphous. The substance is mostly collected by the sawyers and wood-splitters. It is found within the trunks of trees of all sizes, in flattened cavities of the otherwise solid wood which are often parallel to the annual rings. In such place the kino which is at first a viscid liquid, becomes inspissated and subsequently hard and brittle. It may also be obtained in a liquid state by incisions in the stems of growing trees: such liquid kino has occasionally been brought into the London market; it is a viscid treacle-like fluid, yielding by evaporation about 35 per cent. of solid kino.[2]

Authentic specimens of the kino of 16 species of *Eucalyptus* sent from Australia by F. von Müller, have been examined by Wiesner of Vienna.[3] He found the drug to be in most cases readily soluble in water or in spirit of wine, the solution being of very astringent taste. The solution gave with sulphuric acid a pale red, flocculent precipitate of *Kino-tannic Acid*; with perchloride of iron (as in common kino) a dusky greenish precipitate,—except in the case of the kino of *E. obliqua* L'Hér. (Stringy-bark Tree), the solution of which was coloured dark violet.

Wiesner further states, that Eucalyptus kino contains 15 to 17 per cent. of water,—that it affords a mere trace of ash, and no sugar. In some sorts a little *Catechin*[4] was present, and in all *Pyrocatechin*. It contains no pectinous matter, but in some varieties a gum like that of *Acacia*. In one sort, the kino of *E. gigantea* Hook.,[5] gum is so abundant that the drug is nearly insoluble in spirit of wine.

From this examination, it is evident that the better varieties of Eucalyptus kino, such for instance as those derived from *E. rostrata* Schlecht. (*Red* or *White Gum*, or *Flooded Gum* of the colonists), *E. corymbosa* Sm. (*Blood-wood*) and *E. citriodora* Hook., possess all the useful properties of Pterocarpus kino and might with no disadvantage be substituted for it.

[1] *Madeiras e Drogas medicinaes de Angola*, Lisbon, 1862, 37.

[2] Victoria Exhibition, 1861.—Jurors' Report on Class 3. p. 59.

[3] *Zeitschrift des österreich. Apotheker-Vereines* ix. (1871) 497; *Pharm. Journ.* Aug. 5, 1871. 102.

[4] In our opinion this is doubtful.

[5] Bentham unites this species to *E. obliqua* L'Hér (*Flor. Austr.*, iii. 204.)

LIGNUM PTEROCARPI.

Santalinum rubrum, Santalum rubrum ; Red Sanders Wood, Ruby Wood ; F. *Bois de Santal rouge ;* G. *Rothes Sandelholz.*

ınical Origin—*Pterocarpus santalinus* Linn. fil.—A small tree ı exceeding 3½ to 4 feet in girth and 20 to 25 feet in height; it y related to *Pt. Marsupium* Roxb., from which it differs chiefly g broader leaflets always in threes. It is a native of the southern the Indian Peninsula, as Canara, Mysore, Travancore and the ıdel Coast. The districts in which the wood is at present chiefly l are the forests of the southern portion of the Kurnool Hills, ıh and North Arcot (W. and N.W. of Madras). The tree is now ised in regular plantations.[1]

wood is a staple article of produce, and the felling of the trees ly controlled by the forest inspectors. The fine trunk-wood is valued by the natives for pillars in their temples and other ;s, as well as for turnery. The stumps and roots are exported ɔe as a dye-stuff, mostly from Madras.

tory—It is difficult to tell whether the appellation *Red* Sandal-ed in connexion with *Yellow* and *White* Sandal-wood by some of ier writers on drugs, was intended to indicate the inodorous dye-ıder notice or the aromatic wood of a species of *Santalum.* Yet arco Polo[2] alludes to the sandal-wood imported into China, and *red* sandal (" *Cendal vermeil* ") which grows in the island of an (Nicobar), it is impossible to doubt that he intended by this ıme some such substance as that under notice.

:ia d'Orta who wrote at Goa in the middle of the 16th century, listinguished the fragrant sandal of Timor from the red inodorous Tenasserim and the Coromandel Coast. It is remarkable that d of *Pt. santalinus* is distinguished to the present day in all the es of India by names signifying *red-coloured sandal-wood*, though ɔne whatever of the peculiarities of the odorous wood of *Santalum.* ıders Wood was formerly supposed to possess medicinal powers: e now disregarded, and it is retained in use only as a colouring

ing the middle ages, it was used as well as alkanet for culinary s, such as the colouring of sauces and other articles of food. ce in England between 1326 and 1399 was very variable, but verage exceeded 3*s.* per ℔.[3] Many entries for the purchase of ıders along with spices and groceries, occur in the accounts of nastery of Durham, A.D. 1530–34.[4]

ıcription—The wood found in English commerce is mostly that lower parts of the stem and that of the thickest roots. It in the market in ponderous, irregular logs, rarely exceeding the

lome], *Report of the Conservator of* ır 1869-70, Madras, 1870, pp. 3. for figure of the tree, see *Flora of Southern India* of the same ıb. xxii.

ıier, *Livre de Marco Polo*, 580—ıs Willd. grows in the adjacent Islands.

[3] Rogers, *Agriculture and Prices in England*, 1866, i. 631, ii. 545, &c.—The average price of a sheep during the same period was about 1*s.* 6*d.*

[4] *Durham Household Book*, Surtees Society, 1844, 215 ; also Pegge, *Form of Cury*, Lond. 1780, p. xv.

thickness of a man's thigh and commonly much smaller, 3, 4 or 5 feet in length; they are without bark or sapwood, and are externally of a dark colour. The internal wood is of a deep, rich, blood-red, exhibiting in transverse section, zones of a lighter tint, and taking a fine polish.

At the present day, druggists generally buy the wood rasped into small chips, which are of a deep reddish-brown hue, tasteless and nearly without odour.

Microscopic Structure—The wood is built up for the greater part of long pointed cells, having thick walls (libriform). Through this ligneous tissue, there are scattered small groups of very large vessels. In a direction parallel to the circumference of the stem, there are less coloured small parenchymatous layers, running from one vascular bundle to another. The whole tissue is finally traversed by very narrow medullary rays, which are scarcely perceptible to the unaided eye. The parenchymatous cells are each loaded with one crystal of oxalate of calcium, which are so large that, in a piece of the wood broken longitudinally, they may be distinguished without a lens. The colouring matter is contained especially in the walls of the vessels and the ligneous cells.

Chemical Composition—Cold water or fatty oil (almond or olive) abstracts scarcely anything from the wood, and hot water but very little. On the other hand, ether, spirit of wine, alkaline solutions, or concentrated acetic acid, readily dissolves out the colouring matter. Essential oils of bitter almond or clove take up a good deal of the red substance; that of turpentine none at all. This resinoid substance termed *Santalic Acid* or *Santalin*,[1] is said to form microscopic prismatic crystals of a fine ruby colour, devoid of odour and taste, fusing at 104° C., insoluble in water but neutralizing alkalis and forming with them uncrystallizable salts.

Weidel (1870) exhausted the wood with boiling water, containing a little potash, and obtained by means of hydrochloric acid a red precipitate, which was redissolved in boiling alcohol and then furnished *colourless* crystals of *Santal*, $C^8H^6O^3$. They are devoid of odour or taste, not soluble in water, benzol, chloroform, bisulphide of carbon, and but sparingly in ether. Santal yields with potash a faintly yellow solution which soon turns red and green. The wood afforded Weidel not more than 3 per mille of santal.

By exhausting the wood with ether, a red powder having a green hue in reflected light, is obtained, which, when melted with potash, produces *Resorcin* (see art. *Galbanum*) and *Pyrocatechin* (p. 172). Red Sanders Wood yielded us of ash only 0·8 per cent.

Commerce—In the official year 1869–70, Red Sanders Wood produced to the Madras Government a revenue of 26,015 rupees (£2,601). The quantity taken from the forests was reported as 1,161,799 lb.

Uses—Red Sanders Wood is scarcely employed in pharmacy except for colouring the Compound Tincture of Lavender; but it has numerous uses in the arts.

[1] Gmelin, *Chemistry*, xvi. (1864) 259; the formula assigned to santalic acid ($C^{15}H^{14}O^5$) appears to be doubtful. Weidel in proposing the formula $C^{14}H^{12}O^4$ points out that it may be allied to alizarin, $C^{14}H^8O^4$.

BALSAMUM TOLUTANUM.

Balsam of Tolu; F. *Baume de Tolu;* G. *Tolubalsam.*

anical Origin—*Myroxylon Toluifera* H B K. (*Toluifera Bal-* Miller, *Myrospermum toluiferum* A. Rich.),[1] an elegant and ergreen tree with a straight stem, often as much as 40 to 60 feet e ground to the first branch. It is a native of Venezuela and ranada,—probably also of Ecuador and Brazil.

tory—The first published account of Balsam of Tolu, is that of nish physician Monardes, who in his treatise on the productions West Indies, which in its complete form first appeared at Seville ,[2] relates how the early explorers of South America observed Indians collected this drug by making incisions in the trunk ree. Below the incisions they affixed shells of a peculiar black receive the balsam, which being collected in a district near na called *Tolu*, took its name from that place. He adds that it esteemed both by Indians and Spaniards, that the latter buy it h price, and that they have lately brought it to Spain, where it dered to be as good as the famous Balsam of Mecca.

pecimen agreeing with this description, was given to Clusius in y Morgan, apothecary to Queen Elizabeth, but the drug was y not common till a much later period. In a price-list of drugs at Giessen in 1614, we find *Balsamum Hispanicum* and *B. Indi-* nd in a similar list emanating from the city of Basle in 1647, *cum album*, *B. Peruvianum* and *B. siccum*,—the last with the tory words—"*trockner Balsam in der Kürbsen.*[3] Some of these loubtless refer to the drug under notice.

o the tree, of which Monardes figured a broken pod, leaflets of ed 1758, exist in Sloane's herbarium. Humboldt and Bonpland in several places in New Granada during their travels (1799— but succeeded only in gathering a few leaves. Among recent rs, Warszewiez, Triana, Sutton Hayes, and Seemann were ul only in obtaining leaves. Weir in 1863 was more happy, causing a large tree of nearly 2 feet diameter to be felled, cured good herbarium specimens including pods, but no Owing to this tree having been much wounded for balsam, ge and fruits were singularly small and stunted, and its branches wn with lichens.

: which botanists had failed to do, has been accomplished by an ogist, Mr. Anton Goering, who travelling in Venezuela to collect d insects. made it a special object at the urgent request of one L), to procure complete specimens of the Balsam of Tolu tree.

sor Baillon is in favour of discard- nus *Myroxylon* for the older genus originally founded on very im- aterials but which recent investi- ve shown to be identical with it. e change of names may be justi- strict rules of priority, we are of at at present it would be fraught of inconvenience than advantage.

ia de la cosas que se traen de nuestras Indias occidentales, cap. del Balsamo de Tolu.

[3] The lists here referred to are *Medicinetariffs*, and are in the library of the British Museum, bound together in one volume ($\frac{177.\ c.}{5}$). They include Giessen (or Schweinfurt ?) 1614, Bremen 1644, Basle 1647, Rostock 1659, Quedlinburg 1665, Frankfort on Main 1669.

By dint of much perseverance and by watching for the proper season, Mr. Goering obtained in December 1868, excellent flowering specimens and young fruits, and subsequently mature seeds from which plants have been raised in England, Ceylon and Java.

Extraction—The most authentic information we possess on this subject is derived from Mr. John Weir, plant collector to the Royal Horticultural Society of London, who when about to undertake a journey to New Granada in 1863, received instructions to visit the locality producing Balsam of Tolu. After encountering considerable difficulties, Mr. Weir succeeded in observing the manner of collecting the balsam in the forests near Plato, on the right bank of the Magdalena. Mr. Weir's information[1] may be thus summarized:—

The balsam tree has an average height of 70 feet with a straight trunk, generally rising to a height of 40 feet before it branches. The balsam is collected by cutting in the bark two deep sloping notches, meeting at their lower ends in a sharp angle. Below this V-shaped cut, the bark and wood is a little hollowed out, and a calabash of the size and shape of a deep tea-cup is fixed. This arrangement is repeated, so that as many as twenty calabashes may be seen on various parts of the same trunk. When the lower part has been too much wounded to give space for any fresh incisions, a rude scaffold is sometimes erected, and a new series of notches made higher up. The balsam-gatherer goes from time to time round to the trees with a pair of bags of hide, slung over the back of a donkey, and empties into them the contents of the calabashes. In these bags the balsam is sent down to the ports, where it is transferred to the cylindrical tins in which it reaches Europe. The bleeding of the trees goes on for at least eight months of the year, causing them ultimately to become much exhausted, and thin in foliage.

In some districts, as we learn from another traveller, it is customary to let the balsam flow down the trunk into a receptacle at its base, formed of the large leaf of a species of *Calathea*.

From the observations of Mr. Weir, it appears that the balsam tree is plentifully scattered throughout the Montaña around Plato and other small ports on the right bank of the Magdalena. He states that he saw at least 1,500 lb. of the drug on its way for exportation. From another source, we know that it is largely collected in the valley of the Sinu, and in the forests lying between that river and the Cauca. None is collected in Venezuela.

Description—Balsam of Tolu freshly imported, is a light brown, slow-flowing resin, soft enough to be impressible with the finger, but not viscid on the surface. By keeping, it gradually hardens so as to be brittle in cold weather, but it is easily softened by the warmth of the hand. Thin layers show it to be quite transparent and of a yellowish brown hue. It has a very agreeable and delicate odour, suggestive of benzoin or vanilla, especially perceptible when the resin is warmed, or when its solution in spirit is allowed to evaporate on paper. Its taste is slightly aromatic with a barely perceptible acidity, though its alcoholic solution decidedly reddens litmus.

In very old specimens, such as those which during the last century reached Europe in little calabashes of the size and shape of an orange,

[1] *Journ. of the R. Hort. Soc.*, May 1864; *Pharm. Journ.* vi. (1865) 60.

sam is brittle and pulverulent, and exhibits when broken a ıg, crystalline surface. This old balsam is of a fine deep amber l superior fragrance.

ɜn balsam of Tolu is pressed between two warmed plates of glass obtain it in a thin even layer, and then examined with a lens, it ı an abundance of crystals of cinnamic acid. Balsam of Tolu s easily and completely in glacial acetic acid, acetone, alcohol, ırm or solution of caustic potash; it is less soluble in ether, at all in volatile oils, and not in benzol or bisulphide of carbon. ıtion in acetone is devoid of rotatory power in polarized light.

ɜmical Composition—The balsam consists partly of an *ɔus resin*, not soluble in bisulphide of carbon, which is supposed ıe same as the dark resin precipitated by the bisulphide from of Peru. Scharling (1856) assigned the formula $C^{18}H^{20}O^5$, to that he balsam which is soluble in potash.

olu balsam is boiled with water, it yields to it an acid which ıg to Carles[1] is simply *Cinnamic Acid*, and not as was formerly d, a mixture of this acid with benzoic acid. The acid may also ved by boiling bisulphide of carbon.

n distilling the balsam with water, it affords 1 per cent. of $C^{10}H^{16}$, boiling at about 170° C. This liquid rapidly absorbs from the air. By destructive distillation, the balsam affords the bstances as those obtainable from balsam of Peru, among which ınd *Styrol* have been observed. Cinnameïn and styracin are not in balsam of Tolu.

ımerce—The balsam is exported from New Granada, packed in cal tins holding about 10 ℔. each. The quantity shipped from arta in 1870 was 2,002 ℔.; in 1871, 2,183 ℔.; in 1872, 1,206 ℔.

s—Balsam of Tolu has no important medicinal properties. It y used as an ingredient in a pleasant-tasting syrup and in

ılteration—We have twice met with spurious balsam of Tolu, neither instance did the fraudulent drug bear any great resem- o the genuine.

phony which might be mixed with the balsam, can be detected phide of carbon which dissolves it, but removes from the pure ɔnly the cinnamic acid.

BALSAMUM PERUVIANUM.

ıum *Indicum nigrum; Balsam of Peru;* F. *Baume de Pérou, Baume de San Salvador;* G. *Perubalsam.*

anical Origin—*Myroxylon Pereiræ* Klotzsch (*Myrospermum* Royle),[2] a tree attaining a height of about 50 feet, and throwing ading, ascending branches at 6 to 10 feet from the ground.[3]

. *de Pharm.* xix. (1874) 112.

ıme "*Myrospermum of Sonsonate*" he tree provisionally by Pereira ıme he could not identify his very ıeme with any known species, has been translated "*Myroxylon Sonsonatense*," and used in some pharmacological works; but it is not admitted by botanists.

[3] We are not yet prepared to accept the opinion of Prof. Baillon, that *M. Pereiræ* is

It is found in a small district of the State of Salvador in Central America (formerly part of Guatemala), lying between 13°·35 and 14°·10 N. lat., and 89° and 89°·40 W. long., and known as the *Costa del Balsamo* or Balsam Coast. The trees grow naturally in the dense forests; those from which the balsam is obtained are, if in groups, sometimes enclosed, in other cases only marked, but all have their distinct owners. They are occasionally rented for a term of years, or a contract is made for the produce of a certain number.

The principal towns and villages around which balsam is produced, are the following:—Juisnagua, Tepecoyo or Coyo, Tamanique, Chiltiupan, Talnique, Jicalapa, Teotepeque, Comasagua and Jayaque. All the lands on the Balsam Coast are *Indian Reservation Lands.*

The Balsam of Peru tree was introduced in 1861 into Ceylon, where it flourishes with extraordinary vigour.

History—As in the case of Balsam of Tolu, it is to Monardes of Seville that we are indebted for the earliest description of the drug under notice. In a chapter headed *Del Balsamo*,[1] he states that at the time he wrote (1565) the drug was not new, for that it had been received into medicine immediately after the discovery of New Spain. As the conquest of Guatemala took place about 1524, we may conclude that the balsam was introduced into Europe soon afterwards.

Monardes further adds, that the balsam was in such high estimation that it sold for 10 to 20 ducats (£4 10*s.* to £9) the ounce; and that when taken to Rome, it fetched even 100 ducats for the same quantity. The inducement of such enormous prices brought plenty of the drug to Europe, and its value, as well as its reputation, was speedily reduced.

The description given by Monardes of extracting the balsam by boiling the chopped wood of the trunk and branches, raises a doubt as to whether the drug he had in view was exactly that now known; but he never was in America, and may have been misinformed. Evidence that our drug was in use, is afforded by Diego Garcia de Palacio, who in his capacity of Auditor of the Royal Audiencia of Guatemala, wrote an account to Philip II. king of Spain, describing the geography and productions of this portion of his majesty's dominions. In this interesting document, which bears date 1576 and has only recently been published,[2] Palacio tells the king of the great balsam trees of Guaymoco and of the coasts of Tonala,[3] and of the Indian method of promoting the exudation of the balsam by scorching the trunk of the tree. Prior to the conquest of the country by the Spaniards and for a short time after, balsam formed part

specifically identical with *M. Toluifera*, though we admit they are very closely related. According to our observations, the two trees exhibit the following differences:—

M. Toluifera.	*M. Pereiræ.*
Trunk tall and bare, branching at 40 to 60 feet from the ground, and forming a roundish crown of foliage.	Trunk throwing off ascending branches at 6 to 10 feet from the ground.
Racemes dense, 3 to 4½ inches long.	Racemes loose, 6 to 7 inches long.
Legume scarcely narrowed towards the stalk-end.	Legume much narrowed towards the stalk-end.

[1] Occurring in the first book of the work quoted at p. 177 note 2, which was published separately at Seville in 1565.

[2] Squier, *Documents and Relations concerning the Discovery and Conquest of America*, New York, 1859.

[3] The ancient name of the Balsam Coast. Guaymoco is a village between Sonsonate and San Salvador. The pillars of wood of *Myroxylon* in the church, are perhaps, say Squier, the very same as those mentioned with admiration by Palacio.

the tribute paid to the Indian chiefs of Cuscatlan, to whom it was sented in curiously ornamented earthen jars.

The idea of great virtues attaching to the balsam, is shown by the t that in consequence of representations made by missionary priests Central America, Pope Pius V. granted a faculty to the Bishops of e Indies, permitting the substitution of the balsam of Guatemala for at of Egypt, in the preparation of the chrism used in the Roman tholic Church. This document bearing date August 2, 1571, is still eserved in the archives of Guatemala.[1]

In the 16th century, the balsam tree grew in the warm regions of muco and Chiapan in Mexico, whence it was introduced into the mous gardens of Hoaxtepec near the city of Mexico, described by rtes in his letter to Charles V. in 1522.[2]

A rude figure of the tree, certainly a *Myroxylon* and probably the ecies under notice, was published in the *Thesaurus Rerum Medicarum ovæ Hispaniæ* of Hernandez.[3]

The exports of Guatemala being shipped chiefly at Acajutla, were rmerly carried to Callao, the port of Lima, whence they were transitted to Spain. This circumstance led to the balsam acquiring the isleading name of *Peru*, and in part to the notion that it was a producon of South America.

The history of Balsam of Peru was much amplified by a communicaon of the late Dr. Charles Dorat of Sonsonate, Salvador, in 1860 to the *merican Journal of Pharmacy*, and by still further information accomnied by drawings and specimens, transmitted to one of us in 1863.[4]

Extraction of the Balsam—Early in November or December, or ter the last rains, the stems of the balsam trees are beaten with the ck of an axe, a hammer or other blunt instrument, on four sides, a milar extent of bark being left unbruised between the parts that are aten. The bark thus injured soon cracks in long strips, and may be sily pulled off. It is sticky as well as the surface below it, and there a slight exudation of fragrant resin but not in sufficient quantity to worth collecting. To promote an abundant flow, it is customary five or x days after the beating, to apply lighted torches or bundles of burning ood to the injured bark, whereby the latter becomes charred. About week later, the bark either drops or is taken off, and the stem commences exude the balsam. This is collected by placing rags (of any kind or lour), so as entirely to cover the bare wood. As these rags in the course some days become saturated with the exudation, they are collected, rown into an earthen vessel of water, and gently boiled and stirred ntil they appear nearly clean, the balsam separating and sinking to the ttom. This process goes on for some hours, the exhausted rags being om time to time taken out, and fresh ones thrown in. As the rags are moved they are wrung out in a sort of rope bag, and the balsam so saved added to the stock. When the boiler has cooled, the water is decanted, d the balsam is poured into *tecomates* or gourds, ready for the market.

The Indians work a tree a second year, by bruising the bark that was t untouched the previous year. As the bark is said to be renewed

[1] It may be found *in extenso* in the original tin in *Pharm. Journ.* ii. (1861) 447.

[2] Clavigero, *Hist. of Mexico*, English na., i. (1757) pp. 32. 379.

[3] Rome 1628; 2nd ed. 1651.

[4] Hanbury in *Pharm. Journ.* v. (1864) 241. 315.

in the short space of two years, it is possible to obtain from the same tree an annual yield of balsam for many years, provided a few years of rest be occasionally allowed. Clay or earth is sometimes smeared over the bared wood.

The trees sometimes exude spontaneously, a greenish gum-resin of slightly bitter taste, but totally devoid of balsamic odour. It has been analysed by Attfield (see opposite page).

Secretion of the Balsam—No observations have yet been made as to the secretion of the balsam in the wood, or the part that is played by the operation of scorching the bark. Neither the unscorched bark nor the wood, as we have received them, possesses any aromatic odour.

The old accounts speak of a very fragrant resin, far more valuable than the ordinary balsam, obtained by incisions. We have made many inquiries for it, but without the least success. Such a resin is easily obtainable from the trunk of *M. Toluifera*.

Description—Balsam of Peru is a liquid having the appearance of molasses but rather less viscid. In bulk it appears black, but when examined in a thin layer, it is seen to be of a deep orange brown and perfectly transparent. It has a balsamic, rather smoky odour, which is fragrant and agreeable when the liquid is smeared on paper and warmed. It does not much affect the palate, but leaves a disagreeable burning sensation in the fauces.

The balsam has a sp. gr. of 1·15 to 1·16. It may be exposed to the air for years without undergoing alteration or depositing crystals. It is not soluble in water, but yields to it a little cinnamic and traces of benzoic acid; from 6 to 8 parts of crystallized carbonate of sodium are required to neutralize 100 parts of the balsam. It is but partially and to a small extent dissolved by dilute alcohol, benzol, ether or essential or fatty oils, not at all by petroleum-ether. The balsam mixes readily with glacial acetic acid, anhydrous acetone, absolute alcohol or chloroform. Its rotatory power is very insignificant.

Chemical Composition—The peculiar process by which balsam of Peru is obtained, causes it to contain a variety of substances not found in the more natural resin of *Myroxylon Toluifera;* hence the two drugs though derived from plants most closely allied, possess very different properties.

Three parts of the balsam mix readily with one part of bisulphide of carbon, yet a further addition of the latter will cause the separation of a brown flocculent resin. If the balsam be mixed with thrice its weight of bisulphide, a coherent mass of dark resin, sometimes amounting to about 38 per cent. of the balsam, is precipitated. The bisulphide of carbon forms then a perfectly transparent brown liquid. If this solution is shaken with water, the latter removes *Cinnamic* and *Benzoic* acids. To separate them, ammonia is cautiously added, yet not in excess.[1] The solution of cinnamate and benzoate thus obtained and duly concentrated, yields both these acids in white crystals on addition of acetic or hydrochloric acid.

The resin separated by means of bisulphide of carbon as above stated, is a black brittle amorphous mass, having no longer the specific odour of

[1] By saturating the acid aqueous liquid with ammonia, it assumes a transient bright yellow hue; an excess of ammonia transforms the whole mixture into an emulsion, from which the cinnamein again separates but imperfectly.

e balsam. It is soluble in caustic alkalies, also in alcohol; the solution the latter which may be considerably purified by charcoal, reddens mus, and is abundantly precipitated by an alcoholic solution of neutral etate of lead. Kachler (1869) by melting this resin with potash tained about $\frac{2}{3}$ of its weight of proto-catechuic acid.[1] By destructive istillation, it furnishes benzoic acid, styrol C^8H^8, and toluol C^7H^8.

As to the solution obtained with bisulphide of carbon, it forms after the isulphide has evaporated, a brownish aromatic liquid of about 1·1 sp. gr., rmed *Cinnameïn*. This substance may also be obtained by distillation, et less easily, on account of its very high boiling point, about 300° C.

Cinnameïn, $C^{16}H^{14}O^2$, is resolved by concentrated caustic lye into enzylic alcohol, C^7H^8O, and cinnamic acid, $C^9H^8O^2$, whence it follows hat cinnameïn is *Benzylic Cinnamate*. This is, according to Kraut (1858, 869, 1870) and to Kachler (1869, 1870), the chief constituent of the alsam. The former chemist obtained from it nearly 60 per cent. cinnameïn. Kachler assigns to the balsam the following composition: 46 er cent. of cinnamic acid, 32 of resin, 20 of benzylic alcohol. These atter figures however are not quite consistent: 46 parts of cinnamic cid (equivalent = 148) would answer to 73 parts of benzylic cinnamate; nd 20 parts of benzylic alcohol require on the other hand only (equivaent = 108) 27·4 parts of cinnamic acid in order to form benzylic cinnamate (equivalent = 238).

Benzylic cinnamate prepared as above stated, is a thick liquid, miscible both with ether or alcohol, not concreting at − 12° C., boiling t 305° C., yet under ordinary circumstances not without decomposition. By exposure to air, it slowly acquires an acid reaction; by prolonged ction of potash, especially in an alcoholic solution, toluol is also formed. In this process, cinnamate of potassium finally forms a crystalline mass, hile an oily mixture of benzylic alcohol and toluol, the so-called "*Peruvin*," constitutes the liquid part of the whole.

Grimaux (1868) has artificially prepared benzylic cinnamate by eating an alkaline cinnamate with benzylic chloride. Thus obtained, hat substance forms crystals, which melt at 39° C., and boil at 225 to 35° C. They consequently differ much from cinnameïn.

Delafontaine (1868) is of the opinion, that cinnameïn contains besides enzylic cinnamate, cinnamylic cinnamate $C^{36}H^{32}O^4$, the same substance s described under the name of styracin, in the article *Styrax liquida*. He states that he obtained benzylic and cinnamylic alcohol when he decomposed cinnameïn by an alkali. The two alcohols however were eparated only by fractional distillation.

From the preceding investigations it must be concluded, that the bark of the tree contains resin and probably benzylic cinnamate. The latter is no doubt altered by the process of collecting the balsam, which is followed on the Balsam Coast. To this are probably due the free acids in the balsam and its dark colour.

Another point of considerable interest is the fact, that the tree exudes a gum-resin, containing according to Attfield 77·4 per cent. of resin,[2] which is non-aromatic and devoid of cinnamic acid, and therefore entirely distinct from balsam of Peru.

[1] Many other resi as benzoin, guaiacum, dragon's blood, myrrh, are capable of affording the same acid.

[2] *Pharm. Journ.* v. (1864) 248.

Commerce—The balsam is shipped chiefly at Acajutla. It used formerly to be packed in large earthenware jars, said to be Spanish wine-jars, which, wrapped in straw, were sewed up in raw hide. These packages have of late been superseded by metallic drums, which have the advantage of being much less liable to breakage. We have no recent statistics as to the quantity exported from Central America.

Uses—Occasionally prescribed in the form of ointment as a stimulating application to old sores, sometimes internally for the relief of asthma and chronic cough. It is said to be also employed for scenting soap.

Other sorts of Balsam of Peru.

The value anciently set upon balsam for religious and medicinal uses, led to it being extracted from trees no longer employed for the purpose; and many of the products so obtained have attracted the attention of pharmacologists.[1] Parkinson writing in 1640 observes that—"there have beene divers other sorts of liquours, called *Balsamum* for their excellent vertues, brought out of the West Indies, every one of which for a time after their first bringing was of great account with all men and bought at great prices, but as greater store was brought, so did the prices diminish and the use decay . . ."

In a treatise on Brazil written by a Portuguese friar about 1570–1600,[2] mention is made of the "*Cabueriba*" (*Cabure-iba*), from which a much-esteemed balsam was obtained by making incisions in the stem, and absorbing the exudation with cotton wool, somewhat in the same way as Balsam of Peru is now collected in Salvador. This tree is *Myrocarpus frondosus* Allem., now called *Cabriuva preta*. The genus is closely allied to *Myroxylon*.

A fragrant balsamic resin is likewise collected, though in but very small quantity, from *Myroxylon peruiferum* Linn. f., a noble tree of New Granada, Ecuador, Peru, Bolivia, and Brazil. A fine sample of this substance, accompanied by herbarium and other specimens, was presented to one of us (H.) by Mr. J. Correa de Méllo of Campinas (Brazil); it is a resin having a general resemblance to Balsam of Tolu, but of somewhat deeper and redder tint, and greater hardness. Pressed between two slips of warmed glass, it does not exhibit any crystals.

In Salvador, the name *Balsamo blanco* (White Balsam) is applied to the soft resin contained in the large ducts of the legume of *Myroxylon Pereiræ*. This when pressed out, forms a golden yellow, semi-fluid, granular, crystalline mass, hardening by age, having a rather unpleasant odour suggestive of melilot. Stenhouse (1850) obtained from it the neutral resin *Myroxocarpin* $C^{24}H^{34}O^{3}$, in thin colourless prisms, an inch or more in length. We have succeeded in extracting it directly from the pods. This White Balsam, which is distinctly mentioned in the letter of Palacio in 1576 (see p. 180), is a scarce and valuable article, never prepared for the market. A large jar of it was sent to Pereira in 1850.[3]

Another fragrant oleo-resin which has doubtless been confounded with that of a *Myroxylon*, is obtained in Central America from *Liquidambar styraciflua* L., either by incision or by boiling the bark.

[1] Guibourt, *Hist. des Drog.* iii. (1850) 440.

[2] Purchas, *His Pilgrimes*, iv. (1626) 1308.

[3] *Pharm. Journ.* x. (1851) 286.

SEMEN BONDUCELLÆ.

men Guilandinæ; Bonduc Seeds, Grey Nicker Seeds or Nuts; F. *Graines de Bonduc ou du Cniquier, Pois Quéniques, Pois Guénic.*

Botanical Origin—*Cæsalpinia Bonducella* Roxb. (*Guilandina nducella* L.), a prickly, pubescent, climbing shrub of wide distribution, curring in Tropical Asia, Africa and America, especially near the sea. he compressed, ovate, spiny legume is 2 to 3 inches long, and contains e or two, occasionally three or four, hard, grey, globular seeds.

The plant is often confounded with *C. Bonduc* Roxb., a nearly allied rt much rarer species, distinguished by being nearly glabrous, having aflets very unequal at the base, no stipules, erect bracts, and yellow eds.

History—The word *Bunduk*, occurring in the writings of the rabian and Persian physicians, mostly signifies *hazel-nut.*[1] One of ese authors, Ibn Baytar[2] who flourished in the 13th century, further stinguished a drug called *Bunduk Hindi* (Indian Hazel-nut), giving a scription which indicates it plainly as the seed under notice. Both *nduk* and *Bunduk Hindi* are enumerated in the list of drugs of oureddeen Mohammed Abdullah Shirázy,[3] physician to the Mogul mperor Shah Jehan, A.D. 1628–1661.

The pods of *C. Bonducella* were figured by Clusius in 1605, under e name of *Lobus echinodes*, and the plant both by Rheede[4] and mphius. Piso and Marcgraf (1648) noticed it in Brazil and gave me account of it with a bad woodcut, under the designation of *Inimbóy* ow *Inimboja*), or in Portuguese *Silva do Praya.*

In recent times, Bonduc seeds have been employed on account of eir tonic and antiperiodic properties by numerous European practiners in the East, and have been included in the *Pharmacopœia of dia*, 1868.

Description—The seeds are somewhat globular or ovoid, a little mpressed, $\frac{4}{10}$ to $\frac{8}{10}$ of an inch in diameter and weighing 20 to 40 ains. They are of a blueish or greenish grey tint, smooth yet marked slightly elevated horizontal lines of a darker hue. The umbilicus surrounded by a small, dark brown, semilunar blotch opposite the icropyle. The hard shell is from $\frac{1}{32}$ to $\frac{2}{32}$ of an inch thick, and ntains a white kernel, representing from 40 to 50 per cent. of the ight of the seed. It separates easily from the shell, and consists of e two cotyledons and a stout radicle. When a seed is soaked for some urs in cold water, a very thin layer can be peeled from the surface of e testa. The kernel is bitter, but with the taste that is common to st seeds of the family *Leguminosæ.*

Microscopic Structure—The outer layer of the testa, the idermis above alluded to, is composed of two zones of perpendicular, ely packed cells, the outer measuring about 130 mkm., the inner

The word also means *a little ball* or *a nd stone.*

Sontheimer's translation i. 177.

[3] *Ulfaz Udwiyeh*, translated by Gladwin, 1793. No. 542. 551.

[4] *Hort. Malab.* ii. (1679) tab. 22, sub nom. *Caretti.*

100 mkm. in length and only 5 to 7 mkm. in diameter. The walls of these cylindrical cells are thickened by secondary deposits, which in transverse section show usually four or more channels running down nearly perpendicularly through the whole cell.

The spongy parenchyme which is covered by this very distinct outer layer, is made up of irregular, ovate, subglobular or somewhat elongated cells with large spaces between them, loaded with brown masses of tannic matter, assuming a blackish hue when touched with perchloride of iron. The thick walls of these cells frequently exhibit, chiefly in the inner layers, undulated outlines. The tissue of the cotyledons is composed of very large cells, swelling considerably in water and containing some mucilage (as may be ascertained when thin slices are examined in oil), small starch granules, fatty oil, and a little albuminous matter.

Chemical Composition—According to the medical reports alluded to in the *Pharmacopœia of India* (1868), Bonduc seeds, and still more the root of the plant, act as a powerful antiperiodic and tonic.

The active principle has not yet been adequately examined. It may perhaps occur in larger proportion in the bark of the root, which is said to be more efficacious than the seeds in the treatment of intermittent fever.[1]

In order to ascertain the chemical nature of the principle of the seeds one ounce of the kernels[2] was powdered and exhausted with slightly acidulated alcohol. The solution after the evaporation of the alcohol was made alkaline with caustic potash, which did not produce a precipitate. Ether now shaken with the liquid, completely removed the bitter matter and yielded it in the form of an amorphous white powder devoid of alkaline properties. It is sparingly soluble in water, but readily in alcohol, forming intensely bitter solutions; an aqueous solution is not precipitated by tannic acid. It produces a yellowish or brownish solution with concentrated sulphuric acid, which acquires subsequently a violet hue. Nitric acid is without manifest influence. From these experiments, we may infer that the active principle of the Bonduc seeds is a bitter substance not possessing basic properties.

Uses—The powdered kernels either *per se*, or mixed with black pepper (*Pulvis Bonducellæ compositus* Ph. Ind.), are employed in India against intermittent fevers and as a general tonic.

The fatty oil of the seeds is sometimes extracted and used in India; it was shown at the Madras Exhibitions of 1855 and 1857.

LIGNUM HÆMATOXYLI.

Lignum Campechianum v. Campescanum; Logwood, Peachwood; F. *Bois de Campèche, Bois d'Inde;* G. *Campecheholz, Blauholz.*

Botanical Origin—*Hæmatoxylon Campechianum* L., a spreading tree of moderate size, seldom exceeding 40 feet in height, native of the bay of Campeachy, Honduras and other parts of Central America. It

[1] Waring, *Bazaar Medicines*, Travancore, 1860. 18.

[2] Kindly furnished us by Dr. Waring.

was introduced into Jamaica by Dr. Barham[1] in 1715, and is now completely naturalized in that and other of the West India Islands.

History—Hernan Cortes in his letter to the Emperor Charles V. giving an account of his expedition to Honduras in 1525,[2] refers to the Indian towns of Xiculango and Tabasco as carrying on a trade in cacao, cotton cloth, and *colours for dyeing*,—in which last phrase there may be an allusion to logwood. We have sought for some more definite notice of the wood in the *Historia de las Indias* of Oviedo,[3] the first chronicler of America, but without much success.

Yet the wood must have been introduced into England in the latter half of the 16th century, for in 1581, an act of parliament[4] was passed abolishing its use and ordering that any found should be forfeited and burned. In this act, the obnoxious dye is described as "a certain kind of ware or stuff called *Logwood* alias *Blockwood* . . . of late years . . brought into this realm of England." The object of this measure was to protect the public against the bad work of the dyers who, it seems, were unable at that period to obtain durable colours by the use of logwood. Eighty years later, the art of dyeing had so far improved that logwood was again permitted,[5] the colours produced by it being declared as lasting and serviceable as those made by any other sort of dyewood whatsoever.

The wood is mentioned by De Laet (1633) as deriving its name from the town of Campeachy, whence says he, it is brought in great plenty to Europe.[6]

As a medicine, logwood was not employed until shortly before the year 1746, when it was introduced into the London Pharmacopœia under the name of *Lignum tinctile Campechense*.

Description—The tree is fit to be felled when about ten years old; the dark bark and the yellowish sap-wood are chipped off, the stems cut into logs about three feet long, and the red heart-wood alone exported. By exposure to air and moisture, the wood acquires externally a blackish red colour; internally it remains brownish red. It splits well, although of a rather dense and tough texture.

The transverse section of a piece of logwood, exhibits to the naked eye a series of very narrow concentric zones, formed by comparatively large pores, and of small parenchymatous circles separated by the larger and darker rings of the proper woody tissue. The numerous medullary rays are visible only by means of a lens.

For use in pharmacy, logwood is always purchased in the form of chips, which are produced by the aid of powerful machinery. The chips have a feeble, seaweed-like odour, and a slightly sweet, astringent taste, better perceived in a watery decoction than by chewing the dry wood, which however quickly imparts to the saliva its brilliant colour.

Microscopic Structure.—Under a high magnifying power, the concentric zones are seen to run not quite regularly round the centre, but

[1] *Hortus Americanus*, Kingston, Jamaica, p. 91.

[2] *Fifth Letter of Hernan Cortes to the Emperor Charles V.*, Lond. (Hakluyt Society) p. 43.

[3] The first edition bears date 1535. We have used the modern one of Madrid, 1851-55, 4to., and may refer in particular to tom. i. lib. ix. c. 15, iii. lib. xxxi. c. 8 and c. 11.

[4] 23 Eliz. c. 9.

[5] 13-14 Car. ii. c. 11. sect. 26 (A.D. 1662), by which the act of Elizabeth was repealed.

[6] *Novus Orbis*, 1633, 274, a . 265 ?

in a somewhat undulating manner, because they do not correspond, as in our indigenous woods, to regular periods of annual growth. The vascular bundles contain only a few vessels, and are transversely united by small lighter parenchymatous bands. The latter are made up of large, cubic, elongated or polygonal cells, each loaded with a crystal of oxalate of calcium. The large punctuated vessels having frequently 150 mkm. diameter, are surrounded by this woody parenchyme, while the prevailing tissue of the wood is composed of densely packed prosenchyme, consisting of long cylindrical cells (*libriform*) with thick dark red-brown walls having small pores.

The medullary rays are of the usual structural character, running transversely in one to three straight rows; in a longitudinal section, the single rays show from 4 to 40 rows succeeding each other perpendicularly. No regular arrangement of the rays is obvious in a longitudinal section made in a tangential direction. The colouring matter is chiefly contained in the walls of the ligneous tissue and the vessels, and sometimes occurs in crystals of a greenish hue within the latter, or in clefts of the wood.

Chemical Composition—Logwood was submitted to analysis by Chevreul as early as the year 1810,[1] since which period all contributions to a knowledge of the drug, refer exclusively to its colouring principle *Hæmatoxylin*, which Chevreul obtained in a crystallized state and called *Hématine*. The very interesting properties of this substance have been chiefly examined by Erdmann (1842) and by O.Hesse (1858-5

Erdmann obtained from logwood 9 to 12 per cent. of crystalline hæmatoxylin, which he showed to have the formula $C^{16}H^{14}O^{6}$. In pure state it is colourless, crystallizing with 1 or with 3 equivalents of water, and is readily soluble in hot water or in alcohol, but sparingly in cold water or in ether. It has a persistent sweet taste like liquorice. The crystals of hæmatoxylin acquire a red colour by the action of sunlight, as likewise their aqueous solution. They are decomposed by ozone but not by pure and dry oxygen. In presence of alkalies, hæmatoxylin exposed to the air, quickly yields dark purple violet solutions, which soon acquire a yellowish or dingy brownish colour; hence in analytical chemistry hæmatoxylin is used as a test for alkalies.

By the combined action of ammonia and oxygen, dark violet crystalline scales of *Hæmateïn*, $C^{16}H^{12}O^{6} + 3H^{2}O$, are produced. These show a fine green hue, which is also very commonly observable on the surface of the logwood chips of commerce. Hæmateïn may again be transformed into hæmatoxylin by means of hydrogen or of sulphurous acid.

Hæmatoxylin separates protoxide of copper from an alkaline solution of the tartrate, and deviates the ray of polarized light to the right hand. It is not decomposed by concentrated hydrochloric acid; by melting hæmatoxylin with potash, pyrogallol (pyrogallic acid $C^{6}H^{6}O^{3}$) is obtained. Alum and the salts of lead throw down precipitates from solutions of hæmatoxylin, the latter being of a blueish-black colour. Logwood affords upon incineration 3·3 per cent. of ash.

The colouring matter being abundantly soluble in boiling water, an *Extract of Logwood* is also prepared on a large scale. It occurs in commerce in the form of a blackish brittle mass, taking the form of the wooden chest into which it is put while soft. The extract shares the

[1] *Annales de Chimie*, lxxxi. (1812) 128.

properties of hæmatoxylin and hæmateïn: whether it also gum requires investigation.

luction and Commerce—The felling and shipping of logwood al America have been described by Morelet,[1] who states that in ls of Tabasco and Yucatan the trade is carried on in the most l and reckless manner. By advancing money to the natives, or shing them with spirits, arms, or tools, the proprietors of the igage them to fell a number of trees in proportion to their debts. done in the dry season, the rainy period being taken for the t of the logs, which are conveyed chiefly to the island of Carmen iguna de Terminos in South-western Yucatan, and to Frontera mouths of the Tabasco river, at which places European ships cargoes of the wood.

sorts of logwood are found in the London market, namely *Cam-* uoted[2] at £8 10*s.* to £9 10*s.* per ton; *Honduras* £6 10*s.* to £6 15*s.*; *ngo* £5 15*s.* to £6; *Jamaica* £5 2*s.* 6*d.* to £5 10*s.* The imports into ed Kingdom were valued in 1872 at £233,035. The quantities l during that and the previous three years were as follows:—

1869	1870	1871	1872
50,458 tons.	62,187 tons.	39,346 tons.	46,039 tons.

he last mentioned quantity, the British West India Islands 32,792 tons.

s—Logwood in the form of decoction is occasionally administered ic diarrhœa, and especially in the diarrhœa of children. Cases curred in which its use has been followed by phlebitis. Its ment in the art of dyeing is far more important.

lteration—The woods of several species of *Cæsalpinia* imported he name of *Brazil Wood* and used for dyeing red, bear an resemblance to logwood, with which it is said they are sometimes n the form of chips. They contain a crystallizable colouring e called *Brasilin*, $C^{22}H^{20}O^{7}$, which affords with alkalies *red* and ish or purplish solutions. Brasilin may be considered as a nd of hæmatoxylin with phenol $C^{6}H^{6}O$, and indeed yields henylic acid (picric acid) when boiled with nitric acid, while xylin yields oxalic acid only. The best source for brasilin is the *Cæsalpinia Sappan* L., a tree of the East Indies, well known as *Wood*, *Lignum Brasile*, *Verzino* of the Italians, an important f commerce during the middle ages.

FOLIA SENNÆ.

Senna Leaves; F. *Feuilles de Séné*; G. *Sennesblätter.*

anical Origin—The Senna Leaves of commerce are afforded species of *Cassia*[3] belonging to that section of the genus which

e dans l'Amérique centrale, l'île le Yucatan, Paris 1857.

Ledger, 28 Feb. 1874.

writers have removed these plants is to a separate genus named t such subdivision is repudiated by ipal botanists. The intricate of the senna plants has been well t by J. B. Batka in his memoir entitled *Monographie der Cassien Gruppe Senna* (Prag, 1866), of which we have made free use. We have also had the advantage of the recent *Revision of the Genus Cassia* by Bentham (*Linn. Trans.*, xxvii. 1871. 503) and of the labours of Oliver on the same subject in his *Flora of Tropical Africa*, ii. (1871) 268-282.

is distinguished by having leaves without glands, axillary racemes elongating as inflorescence advances, membranaceous bracts which in the young raceme conceal the flower buds but drop off during flowering, and a short, broad, flat legume.

The senna plants are low perennial bushy shrubs, 2 to 4 feet high, having pari-pinnate leaves with leaflets unequal at the base, and yellow flowers. The pods contain 6 or more seeds in each, suspended on alternate valves by long capillary funicles. These run towards the pointed end of the seed, but are curved at their attachment to the hilum just below. The seeds are compressed and of an obovate-cuneate or oblong form, beaked at the narrower end.[1]

The species in question are the following :—

1. *Cassia acutifolia* Delile [2]—a shrub about 2 feet high, with pale subterete or obtusely angled, erect or ascending branches, occasionally slightly zigzag above, glabrous at least below. Leaves usually 4–5-jugate; leaflets oval or lanceolate, acute, mucronate, usually more or less distinctly puberulous or at length glabrous, pale or subglaucous at least beneath, subsessile. Stipules subulate, spreading or reflexed, 1–2 lines long. Racemes axillary, erect, rather laxly many-flowered, usually considerably exceeding the subtending leaf. Bracts membranous, ovate or obovate, caducous. Pedicels at length 2–3 lines. Sepals obtuse, membranous. Two of the anterior anthers much exceeding the rest of the fertile stamens. Legume flat, very broadly oblong, but slightly curved upwards, obliquely stipitate, broadly rounded at the extremity with a minute or obsolete mucro indicating the position of the style on the upper edge; $1\frac{1}{2}$–$2\frac{1}{4}$ inches long, $\frac{3}{4}$–1 inch broad; valves chartaceous, obsoletely or thinly puberulous, faintly transverse-veined, unappendaged. Seeds obovate-cuneate, compressed; cotyledons plane, extending the large diameter of the seed in transverse section.[3]

The plant is a native of many districts of Nubia (as Sukkot, Mahas, Dongola, Berber), Kordofan and Sennaar; grows also in Timbuktu and Sokoto, and is the source of *Alexandrian Senna*.

2. *C. angustifolia* Vahl [4]—This species is closely related to the preceding, the general description of which is applicable to it with the following exceptions. In the present plant the leaflets, which are usually 5–8-jugate, are narrower, being oval-lanceolate, tapering from the middle towards the apex; they are larger, being from 1 to nearly 2 inches long, and are either quite glabrous or furnished with a very scanty pubescence. The legume is narrower (7–8 lines broad), with the base of the style distinctly prominent on its upper edge.

The plant abounds in Yemen and Hadramaut in Southern Arabia; it is also found on the Somali coast, in Sind and the Punjab. In some parts of India it is now cultivated for medicinal use.

The uncultivated plant of Arabia supplies the so-called *Bombay Senna* of commerce, the true *Senna Mekki* of the East. The cultivated and more luxuriant plant, raised originally from Arabian seeds, furnishes the *Tinnevelly Senna* of the drug market.

[1] On the structure of the seed, see Batka, *Pharm. Journ.* ix. (1850) 30.

[2] *Synonyms*—*C. Senna* β. Linn.; *C. lanceolata* Nectoux; *C. lenitiva* Bisch.; *Senna acutifolia* Batka.

[3] We borrow the above description from Prof. Oliver.

[4] *Synonyms*—*C. lanceolata* Roxb.; *C. elongata* Lem. Lis.; *Senna officinalis* Roxb.; *S. angustifolia* Batka.

ry—According to the elaborate researches of Carl Martius,[1] a
of senna cannot be traced back earlier than the time of the
ipion, who flourished in the 9th or 10th century; and it is in
e Arabian physicians that the introduction of the drug to
Europe is due. Isaac Judæus[2] who wrote probably about A.D.
and who was a native of Egypt, mentions senna, the best kind
he says is that brought from Mecca.
(as *Seinen* or *Ssenen*) is enumerated among the commodities
duty at Acre in Palestine at the close of the 12th century.[3]
in 1542, a pound of senna was valued in an official tariff[4] at
e same price as pepper or ginger.
rabian and the mediæval physicians of Europe used both the
leaves, preferring however the former. The pods (*Folliculi*
s still employed in some countries.
obovata Coll.[5] was the species first known to botanists, and it
cultivated in Italy for medicinal use during the first half of
century. Hence the term *Italian Senna* used by Gerarde and

ction—According to Nectoux,[6] whose observations relate to
the close of the last century, the peasants make two senna
nnually, the first and more abundant being at the termination
ins,—that is in September; while the other, which in dry
almost *nil*, takes place in April.
athering consists in simply cutting down the shrubs, and
them on the rocks to the burning sun till completely dry.
is then packed in bags made of palm leaves holding about a
ch, and conveyed by camels to Es-souan and Darao, whence it
rted by water to Cairo. By many travellers it is stated that
li i.e. *mountain senna*, (*C. acutifolia*) finds its way to the
Massowah and Suakin, and thence to Cairo and Alexandria.
obovata which is called by the Arabs *Senna baladi*, i.e. *indi-*
wild senna, grows in the fields of durra (*Sorghum*) at Karnak
r, and in the time of Nectoux was held in such small esteem
tched but a quarter the price of the *Senna jebeli* brought
aravans of Nubia and the Bisharrin Arabs. It is not now

iption—Three kinds of senna are distinguished in English
:—

exandrian Senna—This is furnished by *Cassia acutifolia*
ported in large bales. It used formerly always to arrive in a
d and dirty state, containing in addition to leaflets of senna,

einer Monographie der Sennes-
z., 1867.
maia, Lugd., 1515, lib. 2 Prac-

des Historiens des Croisades, Lois,
7.
n, Edicts et Ordonnances des
nce, éd. 2, ii. (1585) 349.
glaucous shrub with obovate
adly rounded and mucronulate,
game terminated by persistent
marked along the middle of each
valve by a series of crest-shaped ridges corresponding to the seeds. It is more widely distributed in the Nile region than the other species, and is also found in India and (naturalized) in the West Indies. Its leaflets (also pods) may occasionally be picked out of Alexandrian Senna.

[6] *Voyage dans la Haute Egypte . . avec des observations sur les diverses espèces de Séné qui sont répandues dans le commerce*, Paris, 1808. fol.

a variable proportion of leafstalks and broken twigs, pods and flowers; besides which there was almost invariably an accompaniment of the leaves, flowers and fruits of *Solenostemma Argel* Hayne (p. 194), not to mention seeds, stones, dust and heterogeneous rubbish. Such a drug required sifting, fanning and picking, by which most of these impurities could be separated, leaving only the senna contaminated with leaves of argel. But Alexandrian Senna has of late been shipped of much better quality. Some we have recently seen (1872) was, as taken from the original package, wholly composed of leaflets of *C. acutifolia* in a well-preserved condition; and even the lower qualities of senna are never now contaminated with argel to the extent that was usual a few years ago.

The leaflets the general form of which has already been described (p. 190) are ¾ to 1¼ inches long, rather stiff and brittle, generally a little incurled at the edges, conspicuously veined, the midrib being often brown. They are covered with a very short and fine pubescence which is most dense on the midrib. The leaves have a peculiar opaque, light yellowish green hue, a somewhat agreeable tea-like odour, and a mucilaginous, not very marked taste, which however is sickly and nauseous in a watery infusion.

2. *Arabian, Moka, Bombay or East Indian Senna*—This drug is derived from *Cassia angustifolia*, and is produced in Southern Arabia. It is shipped from Moka, Aden and other Red Sea ports to Bombay and thence reaches Europe.

Arabian senna is usually collected and dried without care, and is mostly an inferior commodity, fetching in London sometimes as low a price as ½ to ¼*d.* per ℔. Yet so far as we have observed, it is never adulterated, but consists wholly of senna leaflets, often brown and decayed, mixed with flowers, pods, and stalks. The leaflets have the form already described (p. 190); short adpressed hairs are often visible on their under surface.

3. *Tinnevelly Senna*—Derived from the same species as the last but from the plant cultivated in India, and in a state of far greater luxuriance than it exhibits in the drier regions of Arabia where it grows wild. It is a very superior and carefully collected drug, consisting wholly of the leaflets. These are lanceolate, 1 to 2 inches in length, of a yellowish green on the upper side, of a duller tint on the under, glabrous or thinly pubescent on the under side with short adpressed hairs. The leaflets are less rigid in texture than those of Alexandrian senna, and have a tea-like, rather fragrant smell with but little taste.

Tinnevelly senna has of late fallen off in size, and some recent importations (July, 1873) were not distinguishable from Arabian senna except from having been more carefully prepared. The drug is generally shipped from Tuticorin in the extreme south of India.

Chemical Composition—The analysis of senna with a view to the isolation of its active principle has engaged the attention of numerous chemists, but as yet the results of their labours are not quite satisfactory.

Ludwig (1864) treated an alcoholic extract of senna with charcoal and obtained from the latter by means of boiling alcohol two bitter

inciples, *Sennacrol*, soluble in ether, and *Sennapicrin*, not dissolved by her.

Dragendorff[1] and Kubly (1866) have shown the active substance of nna to be a colloid body, easily soluble in water but not in strong cohol. When a syrupy aqueous extract of senna is mixed with an ual volume of alcohol, and the mucilage thus thrown down has been moved, the addition of a further quantity of alcohol occasions the fall a dark brown, almost tasteless, easily alterable substance, which is dued with purgative properties. It was further shown that this ecipitate was a mixture of calcium and magnesium salts of phosphoric id and a peculiar acid. The last named, separated by hydrochloric id, has been called *Cathartic Acid;* it is a black substance which in e mouth is at first insipid, but afterwards tastes acid and somewhat tringent. In water or strong alcohol it is almost insoluble, and entirely in ether or chloroform; but it dissolves in warm dilute alcohol. From is solution it is precipitable by many acids, but not by tannic. thartic acid is dissolved by alkalis or their carbonates (in the latter se with disengagement of carbonic acid) forming a dark solution from hich it may be precipitated unaltered by an acid. The neutral mmoniacal solution affords precipitates with salts of lead or silver, from hich Dragendorff and Kubly have deduced for the acid the formula $^{[illegible]}H^{192}O^{82}N^{4}S$, which in our opinion is inadmissible.

Groves[2] in 1868, unaware of the researches of Dragendorff and ubly, arrived at similar results as these chemists, and proved conusively that a cathartate of ammonia possesses in a concentrated form e purgative activity of the original drug.

The exactness of the chief facts relative to the solubility in weak cohol of the active principle of senna set forth by the said chemists, s also remarkably supported by the long practical experience of T. d H. Smith of Edinburgh.[3]

When cathartic acid is boiled with alcohol and hydrochloric acid, it resolved into sugar and *Cathartogenic Acid.*

The alcoholic solution from which the cathartates have been separated, stains a yellow colouring matter which was called *Chrysoretin* by Bley d Diesel (1849), but identified as *Chrysophan*[4] by Martius, Batka d others. Dragendorff and Kubly regard the identity of the two bstances as doubtful.

The same alcoholic solution which contains the yellow colouring tter just described, also holds dissolved a sugar which has been named *tharto-mannite.* It forms warty crystals, is not susceptible of alcoholic mentation, and does not reduce alkaline cupric tartrate. The formula signed to it is $C^{42}H^{44}O^{38}$.

Senna contains tartaric and oxalic acids with traces of malic acid. e large amount of ash, 9 to 12 per cent., consisting of earthy and caline carbonates, also indicates the presence of a considerable quantity organic acids.

Commerce—Alexandrian Senna, the produce of Nubia and the gions further south, was formerly a monopoly of the Egyptian Govern-

[1] *Pharm. Zeitschr. f. Russland*, iv. (1866) 445; an abstract in Wittstein's *Vierteljahrschrift* xvi. (1867) 92, and in Gmelin's *Chemistry*, xviii. (1871) 240.

[2] *Pharm. Journ.* x. (1869) 196.

[3] Ibid. 315.

[4] See Art. *Radix Rhei.*

ment, the enjoyment of which was granted to individuals in return for a stipulated payment: hence it was known in continental trade as *Séné de la palte*, while the depots were termed *paltes* and those who farmed the monopoly *paltiers*.[1] All this has long been abolished, and the trade is now free, the drug being shipped from Alexandria.

Arabian senna is brought into commerce by way of Bombay. The quantity of senna imported thither from the Red Sea and Aden in the year 1871–72 was 4,195 cwt., and the quantity exported during the same period, 2,180 cwt.[2]

Uses—Senna leaves are extensively employed in medicine as a purgative.

Adulteration—The principal contamination to which senna is at present liable, arises from the presence of the leaves of *Solenostemma Argel* Hayne, a plant of the order *Asclepiadeæ*, 2 to 3 feet high, growing in the arid valleys of Nubia. Whether these leaves are used for the direct purpose of adulteration, or under the notion of *improving* the drug, or in virtue of some custom or prejudice, is not very evident. It is certain however that druggists have been found who *preferred* senna that contained a good percentage of argel.

Nectoux, to whom we owe the first exact account of the argel plant, describes it as never gathered with the senna by accident or carelessness, but always separately. In fact he saw both at Esneh and Phile, the original bales of argel as well as those of senna: and at Boulak near Cairo at the beginning of the present century, the argel used to be regularly mixed with senna in the proportion of one to four.

The leaves of argel after a little practice are very easily recognized; but their complete separation from senna by hand-picking is a tedious operation. They are lanceolate, equal at the base, of the same size as senna leaflets but often larger, of a pallid, opaque, greyish-green, rigid, thick, rather crumpled, wrinkled and pubescent, not distinctly veined. They have an unmistakeably bitter taste. The small, white, star-like flowers, or more often the flower buds, in dense corymbs are found in plenty in the bales of Alexandrian senna. The slender, pear-shaped follicles, when mature 1½ inches long, with comose seeds are less frequent. It has been shown by Christison[4] that argel leaves administered *per se*, have but a feeble purgative action though they occasion griping. It is plain therefore that their admixture with senna should be deprecated.

The leaves or leaflets of several other plants were formerly mixed occasionally with senna, as those of the poisonous *Coriaria myrtifolia* L., a Mediterranean shrub, of *Colutea arborescens* L., a native of Central and Southern Europe, and of the Egyptian *Tephrosia Apollinea* DC. We have never met with any of them.[5]

[1] From the Italian *appaltare*, to let or farm.

[2] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1871–72, pt. ii. 21. 98.

[3] Op. cit. (See p. 191).

[4] *Dispensatory*, ed. 2. 1848. 850.

[5] The reader will find figures of these leaves contrasted with Senna in Pereira's *Elem. of Mat. Med.* ii. part 2 (1853) 1866.

FRUCTUS CASSIÆ FISTULÆ.

Fistula; Purging Cassia; F. *Casse, Canefice, Fruit du Caneficier;* G. *Röhrencassie.*

anical Origin—*Cassia Fistula* L. (*Cathartocarpus Fistula* Pers., *obium Fistula* Willd.), a tree indigenous to India, but now ed or subspontaneous in Egypt, Tropical Africa, the West Indies zil. It is from 20 to 30 feet high (in Jamaica even 50 feet) and ng pendulous racemes of beautiful, fragrant, yellow flowers. tanists have established for this tree and its near allies a separate n account of its elongated, cylindrical, indehiscent legume, but it is retained in the genus *Cassia.*

tory—The name *Casia* or *Cassia* was originally applied ex- to a bark related to cinnamon which, when rolled into a tube or s distinguished in Greek by the word *σύριγξ*, and in Latin by *fistula.* Thus Scribonius Largus[1] a physician of Rome during s of Tiberius and Claudius, with the latter of whom he is said visited Britain, A.D. 43, uses the expression "*Casiæ rufæ fistu-* in the receipt for a collyrium. Galen[2] describing the different of cassia, mentions that called *Gizi*[3] as being quite like n or even better; and also names a well-known cheaper sort, a strong taste and odour, which is called *fistula,* because it is p like a tube.

asius, physician to the Emperor Julian in the latter half of the beginning of the 5th century, describes *Cassia fistula* as a *bark* h there are several varieties, having pungent and astringent es ("*omnes cassiæ fistulæ vires habent acriter excalfacientes et tes*"), and sometimes used in the place of cinnamon.[4]

doubtless the same drug which is spoken of by Alexander us[5] (6th century) as *Κασίας συριγξ* (*casia fistula*) in connexion stus, pepper and other aromatics; and named by other Greek s *Κασία συριγγώδης* (*casia fistularis*).

Cassia Fistula of modern medicine is noticed by Joannes s, who flourished at Constantinople towards the close of the tury; and as he describes it with particular minuteness,[6] it is that he did not consider it well known. The drug is also ed by several writers of the school of Salernum. It was a familiar in England in the time of Turner,[7] 1568.

tree was figured in 1553 by the celebrated traveller Belon who

nitiones Medicamentorum cap. 4.

tidot. i. c. 14.

d likewise among the commodities uty at Alexandria in the 2nd cen- ncent, *Commerce of the Ancients,*

a *Hildegardis,* Argent. 1533. 227. tii. J. Guinterio interprete, Basil., vii. c. 8.

madmodum si ventrem mollire ms, pruna, et præcipuè Damas- cena adjicimus, atque quipniam ferè nigræ nominatæ casiæ. Est autem fructus ejus fistulosus et oblongus, nigrum intus humorem concretum gestans, qui haudquaquam una continuitate coaluit, sed ex intervallo tenuibus lignosisque membranulis dirimitur, habens ad speciei propagationem grana quædam seminalia, siliquæ illi quæ nobis innotuit, adsimilia." —*Methodus Medendi,* lib. v. c. 2.

[7] *Herball,* part 3. 20.

met with it in the gardens of Cairo, and in 1592 by Prosper Alpinus who also saw it in Egypt.

Description—The ovary of the flower is one-celled with numerous ovules, which as they advance towards maturity, become separated by the growth of intervening septa. The ripe legume is cylindrical, dark chocolate-brown, $1\frac{1}{2}$ to 2 feet long, by $\frac{3}{4}$ to 1 inch in diameter, with a strong short woody stalk, and a blunt end suddenly contracted into a point. The fibro-vascular column of the stalk is divided into two broad parallel seams, the dorsal and ventral sutures, running down the whole length of the pod. The sutures are smooth, or slightly striated longitudinally; one of them is formed of two ligneous bundles coalescing by a narrow line. If the legume is curved, the ventral suture commonly occupies its inner or concave side. The valves of the pods are marked by slight transverse depressions (more evident in small specimens) corresponding to the internal divisions, and also by inconspicuous transverse veins.

Each of the 25 to 100 seeds which a legume contains, is lodged in a cell formed by very thin woody dissepiments. The oval, flattish seed, from $\frac{3}{10}$ to $\frac{4}{10}$ of an inch long, of a reddish-brown colour, contains a large embryo whose yellowish veined cotyledons cross diagonally, and seen on transverse section, the horny white albumen. One side is marked by a dark line (the raphe). A very slender funicle attaches the seed to the ventral suture.

In addition to the seeds, the cells contain a soft saccharine pulp which in the recent state fills them up, but in the imported pods appears only as a thin layer, spread over the septum, of a dark viscid substance of mawkish sweet taste. It is this pulp which is made use of in pharmacy.

Microscopic Structure—The bands above described running along the whole pod, are made up of strong fibro-vascular bundles mixed with sclerenchymatous tissue. The valves consist of parenchymatous cells, and the whole pod is coated with an epidermis exhibiting small tabular cells, which are filled with dark granules of tannic matter. A few stomata are also met with. The thin brittle septa of the pod are composed of long ligneous cells, enclosing here and there crystals of oxalate of calcium.

The pulp itself, examined under water, is seen to consist of loose cells, not forming a coherent tissue. They enclose chiefly granules of albuminoid matters and stellate crystals of oxalate of calcium. The cell walls, assume on addition of iodine, a blue hue if they have been previously washed by potash lye. The seeds are devoid of starch, but yield a copious amount of thick mucilage, which surrounds them like a halo if they are macerated in water.

Chemical Composition—No peculiar principle is known to exist either in the woody or the pulpy portion of cassia fistula. The pulp contains sugar in addition to the commonly occurring bodies noticed in the previous section.

Uses—The pulp separated from the woody part of the pods by crushing the latter, digesting them in hot water, and evaporating the strained liquor, is a mild laxative in common domestic use in the

outh of Europe,[1] but in England scarcely ever now administered except in the form of the well-known *Lenitive Electuary* (*Confectio sennæ*), of which it is an ingredient.

Commerce—Cassia fistula is shipped to England from the East and West Indies, but chiefly from the latter. The pulp *per se* has been occasionally imported, but it should never be employed when the legumes for preparing it can be obtained.

Substitutes—The pods of some other species of *Cassia* share the structure above described and have been sometimes imported.

Those of *C. grandis* L. f. (*C. Brasiliana* Lamarck), a tree of Central America and Brazil, are of much larger size, showing when broken transverely an elliptic outline, whose longer diameter exceeds an inch. The valves have very prominent sutures and transverse branching veins. The pulp is bitter and astringent.

The legumes of *Cassia moschata* H B K.,[2] a tree 30 to 40 feet high, growing in New Granada and known there as *Cañafistola de purgar*, bear a close resemblance to those of *Cassia Fistula* L., except that they are a little smaller and rather less regularly straight. They contain a sweetish astringent pulp of a bright brown hue. When crushed and exposed to the heat of a water-bath, they emit a pleasant odour like sandal-wood. The pulp is coloured dark blackish green by perchloride of iron.

TAMARINDI PULPA.

Tamarindus, Fructus Tamarindi; Tamarinds; F. *Tamarins;* G. *Tamarinden.*

Botanical Origin—*Tamarindus indica* L.—The tamarind is a large handsome tree, growing to a height of 60 to 80 feet, and having abruptly pinnate leaves of 10 to 20 pairs of small oblong leaflets, constituting an abundant and umbrageous foliage. Its purplish flower buds and fragrant, red-veined, white blossoms, ultimately assuming a yellowish tinge, contribute to its beautiful aspect and cause it to be generally cultivated in tropical countries.

T. indica appears to be truly indigenous to Tropical Africa between 8° N. and 18° S. lat. It grows not only in the Upper Nile regions (Sennaar, Kordofan, Abyssinia), but also in some of the remotest districts visited by Speke, Grant, Kirk, and Stanley, and as far south as the Zambesi. According to F. von Müller,[3] it occurs in Tropical Australia.

It is found throughout India, and as it has Sanskrit names it may even be really wild in at least the southern parts of the peninsula. It grows in the Indian islands, and Crawfurd[4] has adduced reasons to show that it is probably a true native of Java. The mediæval Arabian authors describe it as growing in Yemen, India, and Nigritia.

[1] Thus there were imported into Leghorn in 1871, 103 tons of *Cassia Fistula* and Granada.—*Consular Reports* 1873, part i.

[2] Hanbury in *Linn. Trans.* xxiv. 161. 28; *Pharm. Journ.* v. (1864) 348.

[3] Exposition intercoloniale,—*Notes sur la Végétation de l'Australie*, Melbourne, 1866. 8.

[4] *Dict. of Indian Islands*, 1856. 425.

The tamarind has been naturalized in Brazil and Mexico. Hern who resided in the latter country from 1571 to 1575, speaks o "*nuper . . . ad eas oras translata.*" It abounds in the West where it was also introduced together with ginger by the Spani an early period. The tree found in these islands bears short fewer-seeded pods than that of India, and hence was formerly re as a distinct species, *Tamarindus occidentalis* Gärtn.

History—The tamarind was unknown to the ancient Gree Romans; nor have we any strong evidence that the Egyptian acquainted with it,[2] which is the more surprising considering th tree appears indigenous to the Upper Nile countries, and that it is held in the greatest esteem in those regions.[3]

The earliest mention of tamarind occurs in the ancient S writings where it is spoken of under several names.[4] From the E it would seem that the fruit became known to the Arabians, who it *Tamare-hindi* i.e. *Indian Date.* Under this name it was men by Isaac Judæus,[5] Avicenna,[6] and the Younger Mesue,[7] and a Alhervi[8] a Persian physician of the 10th century who describe black, of the flavour of a Damascene plum, and containing fibr stones.

It was doubtless from the Arabians that a knowledge of the tan as of so many other eastern drugs, passed during the middle ag Europe through the famous school of Salernum. *Oxyphœnica* *φοίνικα*) and *Dactyli acetosi* are names under which we meet wit the writings of Matthæus Platearius and Saladinus, the latter of as well as other authors of the period, considered tamarinds as th of a wild palm growing in India.

The abundance of tamarinds in Malabar, Coromandel, and Ja reported to Manuel, king of Portugal, in 1516, in the letter apothecary Pyres[9] on the drugs of India. A correct description tree was given by Garçia d'Orta about fifty years later.

Preparation—Tamarinds undergo a certain preparation befor brought into commerce.

In the West Indies, the tree matures its fruit in June, Ju August, and the pods are gathered when fully ripe, which is kno the fragility of the outer shell. This latter which easily breaks b the finger and thumb, is then removed, and the pods deprived of fragments are placed in layers in a cask, and boiling sy poured over them till the cask is filled. When cool, the cask is and is then ready for sale. Sometimes layers of sugar are between the fruits previous to the hot syrup being added.[10]

[1] *Nova plantarum, animalium et mineralium historia*, Romæ 1651. 83.

[2] Sir Gardner Wilkinson (*Ancient Egyptians*, i. 1841, 78) says that tamarind stones have been found in the tombs of Thebes; but on consulting Dr. Birch and the collections in the British Museum we have obtained no confirmation of the fact.

[3] Barth speaks of it as *an invaluable gift of Providence: Reisen und Entdeckungen in Nord- und Centralafrica*, Gotha 1858. i. 614; iii. 334. 400; iv. 173.

[4] *Susrutas Ayurvedas*, ed. He (1844) 141, iii. (1850) 171.

[5] *Opera Omnia*, Lugd. 1515, lib. tices, c. 41.

[6] *Opera*, Venet. 1564. ii. 339.

[7] *Opera*, Venet. 1561. 52.

[8] *Fundamenta Pharmacologiæ*, e mann, Vindob. 1830, 49.

[9] *Journ. de Soc. Pharm. Lusit.* ii. (

[10] Lunan, *Hortus Jamaicensis*, 224; Macfadyen, *Flora of Jamai* 335.

East Indian tamarinds are also sometimes preserved with sugar, but sually they are exported without such addition, the outer shell being emoved and the fruits being pressed together into a mass.

In the Upper Nile regions (Darfur, Kordofan, Sennaar) and in Arabia, he softer part of tamarinds is, for the sake of greater permanence and onvenience of transport, kneaded into flattened round cakes, 4 to 8 nches in diameter and an inch or two thick, which are dried in the sun. They are of firm consistence and quite black, externally strewn with airs, sand, seeds and other impurities; they are largely consumed in Egypt and Central Africa, and sometimes find their way to the south of Europe as *Egyptian Tamarinds.*

Description—The fruit is an oblong, or linear oblong, slightly compressed, curved or nearly straight, pendulous legume, of the thickness f the finger and 3 to 6 inches in length, supported by a woody stalk. It has a thin but hard and brittle outer shell or epicarp, which does ot split into valves or exhibit any very evident sutures. Within the picarp is a firm, acid, juicy pulp, on the surface of which and starting rom the stalk are strong woody ramifying nerves; one of these extends long the dorsal (or concave) edge, two others on either side of the entral (or convex) edge, while between these two there are usually 2, or 4 less regular and more slender nerves,—all running towards the pex and throwing out branching filaments.

The seeds, 4 to 12 in number, are each of them enclosed in a tough, embranous cell (endocarp), surrounded by the pulp (sarcocarp). They re flattened, and of irregular outline, being roundish, ovate, or obtusely our-sided, about $\frac{6}{16}$ of an inch long by $\frac{3}{16}$ thick, with the edge broadly eeled or more often slightly furrowed. The testa is of a rich brown, arked on the flat sides of the seed by a large scar or areole, of rather uller polish than the surrounding portion which is somewhat radially riated. The seed is exalbuminous, with thick hard cotyledons, a hort straight included radicle, and a plumule in which the pinnation of he leaves is easily perceptible.

Tamarinds are usually distinguished in trade as *West Indian* and *East Indian*, the former being preserved with sugar, the latter without.

1. *West Indian Tamarinds, Brown or Red Tamarinds.*—A right reddish-brown, moist, saccharine mass consisting of the pulpy ternal part of the fruit, usually unbroken, mixed with more or less of rup. It has a very agreeable and refreshing taste, the natural acidity f the pulp being tempered by the sugar. It is this form of tamarinds hat is usually found in the shops.

2. *East Indian Tamarinds, Black Tamarinds.*—These differ rom the last described in that they are preserved without the use of ugar. They are found in the market in the form of a firm clammy ack mass, consisting of the pulp mixed with the seeds, stringy fibres nd some remains of the outer shell. The pulp has a strong acid taste.

Notwithstanding the rather uninviting appearance of East Indian marinds, they afford a good pulp which may be satisfactorily used making the *Confectio Sennæ* of pharmacy. In fact, on the continent is sort of tamarind alone is employed for medicinal purposes.

Microscopic Structure—The soft part of tamarinds consists of a

tissue of thin-walled cells of considerable size, which is traversed by long fibro-vascular bundles. In the former, a few very small starch-granules are met with, and more numerous crystals which are probably bitartrate of potassium.

Chemical Composition—Water extracts from unsweetened tamarinds, sugar together with acetic, tartaric and citric acids, the acids being combined for the most part with potash. The neutralized solution reduces alkaline cupric tartrate after a while without heat, and therefore probably contains grape sugar. On evaporation, cream of tartar and sugar crystallize out. The volatile acids of the fatty series, the presence of which in the pulp has been pointed out by Gorup-Besanez, have not been met with by other chemists. Tannin is absent as well as oxalic acid. We have ascertained that in East Indian tamarinds, citric acid is present in but small quantity. No peculiar principle to which the laxative action of tamarinds can be attributed is known.

The fruit-pulp diffused in water forms a thick, tremulous, somewhat glutinous and turbid liquid. It was examined as early as the year 1790 by Vauquelin under the name of "*vegetable jelly*,"—the first described among the pectic class of bodies.

The hard *seeds* have a testa which abounds in tannin, and after long boiling is easily separated, leaving the cotyledons soft. These latter have a bland mucilaginous taste and are consumed in India as food during times of scarcity.

Commerce—Tamarinds are shipped in comparatively small quantities from several of the West Indian islands.

The export from the Bombay Presidency in the year 1871-72, was 6286 cwt., which quantity was shipped chiefly to the Persian Gulf, Sind, and ports of the Red Sea.[1]

Uses—In medicine, tamarinds are considered to be a mild laxative; they are sometimes used to make a refrigerant drink in fever. In hot countries, especially the interior of Africa, they are regarded as of the highest value for the preparation of refreshing beverages. The *Black Tamarinds* are said to be used in the manufacture of tobacco.

BALSAMUM COPAIBA.

Copaiba; Balsam of Copaiba[2] *or Copaiva, Balsam Capivi;* F. *Baume ou Oléo-résine de Copahu;* G. *Copaiva-balsam.*

Botanical Origin—The drug under notice is produced by trees belonging to the genus *Copaifera*, of which there are 10 or 11 species, natives of the warmer countries of South America.[3] Some are found in moist forests, others exclusively in dry and elevated situations. They vary in height and size, some being umbrageous forest trees while others have only the dimension of shrubs; it is from the former alone that the oleo-resin is obtained.

[1] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1871-72, pt. ii. 65.

[2] We see no good reason for discarding the popular term *balsam*, which was originally applied to an oleo-resin of strictly analogous character.

[3] Three or four species are known from Tropical Africa.

The following are reputed to furnish the drug, but to what extent , contributes is not fully known.

1. *Copaifera officinalis L.* (*C. Jacquini* Desf.), a large tree of the hot t region of New Granada as far north as Panama, of Venezuela and island of Trinidad.

2. *C. Guianensis* Desf., a tree of 30 to 40 feet high, very closely ed to the preceding, native of Surinam, Cayenne, also of the Rio ro between Manaos and Barcellos (Spruce.) According to Bentham ems to be the same species as the *C. bijuga* of Hayne.[1]

3. *C. coriacea* Mart. (*C. cordifolia* Hayne), a large tree found in the *ingas* or dry woods of the Brazilian provinces of Bahia and Piauhy.

4. *C. Langsdorffii* Desf. (*C. nitida* Hayne, *C. Sellowii* Hayne, ? *C. ieui* Hayne), a polymorphous species, varying in the form and size of ets, and also in dimensions, being either a shrub, a small bushy tree, large tree of 60 feet high. Bentham admits besides the type, three varie- :—*β. glabra* (*C. glabra* Vogel), *γ. grandifolia*, *δ. laxa* (*C. laxa* Hayne). The tree grows on dry *campos*, *caatingas* and other places in the pro- es of S. Paulo, Minas Geraes, Goyaz, Mato Grosso, Bahia and Ceará; therefore distributed over a vast area. According to Gardner,[2] the ilian traveller, it yields an abundance of balsam.

In addition to these species, must be mentioned a tree described by ne and commonly cited under the name of *Copaifera multijuga*, as ecial source of the drug shipped from Pará.[3] As its name implies, remarkable for the number of leaflets (6 to 10 pairs) on each leaf. it is only known from some leaves in the herbarium of Martius :h Bentham, who has examined them, informs us are unlike those of *Copaifera* known to him, though certainly the leaflets are dotted oil-vessels as in some species. In the absence of flowers and ts, there is no sufficient evidence to prove that it belongs even to genus *Copaifera*. It is not mentioned by Martius in his *Systema eriæ Medicæ Brasiliensis* (1843) as a source of the drug.

History—Among the early notices of Brazil, is a treatise by a Portu- e friar who had resided in that country from 1570 to 1600. The uscript found its way to England, was translated, and was published Purchas[4] in 1625. Its author notices many of the natural produc- s of the country, and among others *Cupayba* which he describes as a e tree from whose trunk, when wounded by a deep incision, there s in abundance a clear oil much esteemed as a medicine.

Father Acuña[5] who ascended the Amazon from Pará arriving at to in 1638, mentions that the country affords very large cassia la, excellent sarsaparilla, and the oils of andirova and *Copaiba*, ood as balsam for curing wounds.

Piso and Marcgraf[6] who were physicians to the Count of Nassau,

Hayne (1827) enumerated and figured species, some of them founded on very defect materials. Bentham in the *Flora Brasil.* of Martius and Endlicher (fasc. *Leguminosæ* ii. 1870, pp. 239-244) adds only 11, one of which is doubtful as to genus.

MS. attached to specimens in the Kew herbarium.

Alle Arten geben mehr oder weniger Balsam, und den meisten giebt die in der Provinz Para vorkommende *Copaifera multijuga*."—Hayne, *Linnæa* i. (1826) 429.

[4] *Pilgrimes and Pilgrimage*, Lond. iv. (1625) 1308.

[5] *Descubrimiento del gran Rio de las Amazonas*, Madrid, 1641, No. 30.

[6] *Hist. Nat. Brasiliæ*, 1648, Piso, 56, Marcgraf, 130.

governor of the Dutch establishments in Brazil, each give an account of the *Copaiba* and the method of obtaining its oleo-resin. The former states that the tree grows in Pernambuco and the island of Maranhon, whence the balsam is conveyed in abundance to Europe.

The drug was formerly brought into European commerce by the Portuguese, and used to be packed in earthen pots pointed at the lower end; it often arrived in a very impure condition.[1] In the London Pharmacopœia of 1677, it was called *Balsamum Capivi*, which is still its most popular name.

Secretion—Karsten states that he observed resiniferous ducts, frequently more than an inch in diameter, running through the whole stem. He is of the opinion, that the cell-walls of the neighbouring parenchyme are liquefied and transformed into the oleo-resin.[2] We are not able to offer any argument in favour of this opinion.

Extraction—According to the testimony of the very few travellers who have given any account of the matter, the balsam is obtained by cutting out a wedge from the trunk of the tree near its base, reaching to the very heart. From this great wound the balsam flows usually in such abundance that many pounds may be collected in a few hours. If no flow takes place, the aperture is closed with wax or clay, and reopened after the lapse of some days when a copious exudation generally follows. Sometimes the required cavity is made by means of a large auger.

In the vessels already alluded to, the balsam sometimes collects in so large a quantity, that the trunk is unable to sustain the inward pressure, and *bursts*. This curious phenomenon is thus referred to in a letter addressed to one of us by Mr. Spruce:—"I have three or four times heard what the Indians assured me was the bursting of an old capivi-tree, distended with oil. It is one of the strange sounds that sometimes disturb the vast solitudes of a South American forest. It resembles the boom of a distant cannon, and is quite distinct from the crash of an old tree falling from decay which one hears not unfrequently."

A similar phenomenon is known in Borneo. The trunks of aged trees of *Dryobalanops aromatica* contain large quantities of oleo-resin or Camphor Oil,[3] which appears to be sometimes secreted under such pressure that the vast trunk gives way. "There is another sound" says Spenser St. John[4] "only heard in the oldest forests, and that is as if a mighty tree were rent in twain. I often asked the cause, and was assured it was the camphor tree splitting asunder on account of the accumulation of camphor in some particular portion."

Balsam Capivi is collected by the Indians on the banks of the Orinoco and its upper affluents, and carried to Ciudad Bolivar (Angostura); some of this balsam reaches Europe by way of Trinidad. But it is obtained much more largely on the tributaries of the Casiquiari and Rio Negro (the Siapa, Içanna, Uaupés, &c.) and is sent down to Pará. Most of the northern tributaries of the Amazon, as the Trombetas and Nhamundá, likewise furnish a supply. According to Spruce, in the Amazon valley it is the tall virgin forest, *Caaguaçú* of the Brazilians,

[1] Valmont de Bomare, *Dict. d'Hist. Nat.* i. (1775) 387.

[2] *Botanische Zeitung*, xv. (1857) 316.

[3] Motley in Hooker's *Journ. of Botany*, iv. (1852) 201.

[4] *Life in the Forests of the Far East*, ii. (1862) 152.

the Venezuelans, that yields most of the oils and gum-
the low, dry *caatingas*, or the riparial forests. The
traveller tells us that in Southern Venezuela, capivi is
el Aceite (*the oil*,) the name *Balsamo* being that of the
'ras Oil, obtained from a species of *Nectandra*.
paiba is also largely exported from Maracaibo where,
ngel[1] it is produced by *C. officinalis*, the *Canime* of the

n—Copaiba is a more or less viscid fluid, varying in tint
low to a light golden brown, of a peculiar aromatic, not
ır, and a persistent, acrid, bitterish taste. Pará copaiba
is sometimes nearly colourless and almost as fluid as
ılsam is usually quite transparent, but there are varieties
always opalescent. Its sp. gr. varies from 0·940 to
; as the drug contains a greater or less proportion of vola-
.ba becomes more fluid by heat; if heated in a test-tube
some time, it does not lose its fluidity on cooling. It is
ıtly fluorescent. It dissolves in several times its weight
rit of wine, and generally in all proportions in absolute
e, or bisulphide of carbon, and is perfectly soluble in an
f benzol. Glacial acetic acid readily dissolves the resin
ential oil.
ıt is rich in resin of an acid character, unites with the
to form a gradually hardening mass, provided a small
water is present. Thus 8 to 16 parts of balsam will
stiff compound when gently warmed with 1 part of
nesia; and still more easily with lime or baryta.
s first shown (1861) that copaiba varies in its optical
ıple from Trinidad examined by one of us was strongly
ereas we found Pará balsam to be levogyre.[4]
nd Maranham balsams are regarded in wholesale trade as
and experienced druggists are able to distinguish them
and appearance, and especially by the greater consistence
ıam drug. Maracaibo balsam is reckoned as another
now rarely seen in the English market. West Indian
ally said to be of inferior quality, but except that it is
scent, we know not on what precise grounds.

Composition—The balsam is a solution of resin in
ıd therefore analogous to the fluid turpentines of the

e oil, *Oleum Copaibæ*, constitutes about 40 to 60 per cent.
according to the age of the latter and its botanical origin.
position and general chemical properties of turpentine oil,
point is 245° C. or even higher. It smells and tastes

Gesellschaft für Erdkunde
) 435.
as this which had been
ıdon in 1873; though re-
ers with suspicion, we are
t it was sophisticated.
case with some very
ıs collected for one of us
in Central America by De Warszewicz, but other samples which we had no reason to suppose adulterated, left a certain amount of white residue when treated with *twice their weight* of alcohol sp. gr. ·796.

[4] Fluckiger in Wiggers and Husemann's *Jahresbericht* for 1867, 162, and for 1868. 140.

like the balsam, and dissolves in from 8 to 30 parts of spirit of wine. Most samples of copaiba oil turn the plane of polarization to the left, but in common with oil of turpentine, the oil exhibits isomeric modifications differing in optical as well as in other physical properties. The sp. gr. varies from about 0·88 to 0·91.

After the oil of copaiba has been removed by distillation, there remains a brittle amorphous resin of an acid character, soluble both in benzol and amylic alcohol, and yielding only amorphous salts. Sometimes copaiba contains a small amount of crystallizable resin-acid, as first pointed out in 1829 by Schweitzer. By exposing a mixture of 9 parts of copaiba and 2 parts of aqueous ammonia (sp. gr. 0·95) to a temperature of − 10° C., Schweitzer obtained crystals of the acid resin termed *Copaivic Acid.* They were analysed in 1834 by H. Rose, and exactly measured and figured by G. Rose. Hess (1839) showed that Rose's and his own analyses assign to copaivic acid the formula $C^{20}H^{32}O^{2}$. It agrees with Maly's abietic acid from colophony in composition, but not in any other way. Copaivic acid is readily soluble in alcohol, and especially in warmed copaiba itself; much less in ether. We have before us crystals probably of copaivic acid, which have been spontaneously deposited in an authentic specimen of the oleo-resin of *Copaifera officinalis* from Trinidad, which we have kept for several years. The crystals may be easily dissolved by warming the balsam; on cooling the liquid, they again make their appearance after the lapse of some weeks. After re-crystallization from alcohol they fuse at 116–117° C., forming an amorphous transparent mass which quickly crystallizes if touched with alcohol.

An analogous substance, *Oxycopaivic Acid,* $C^{20}H^{28}O^{3}$, was examined in 1841 by H. von Fehling, who met with it as a deposit in Pará Copaiba. And lastly, Strauss (1865) extracted *Metacopaivic Acid,* $C^{22}H^{34}O^{4}$, from the balsam imported from Maracaibo. He boiled the latter with soda lye which separated the oil; the heavier subjacent liquid was then mixed with chloride of ammonium, which threw down the salts of the amorphous resin-acid, leaving in solution those of the metacopaivic acid. The latter acid was separated by hydrochloric acid and recrystallization from alcohol. We succeeded in obtaining metacopaivic acid by washing the balsam with a dilute solution of carbonate of ammonium, and precipitating by hydrochloric acid. The precipitate dissolved in dilute alcohol yields the acid in small crystals, but to the amount of only about one per cent.

These resin-acids have a bitterish taste and an acid reaction; their salts of lead and silver are crystalline but insoluble; metacopaivate of sodium may be crystallized from its watery solution.

Commerce—The balsam is imported in barrels direct from Pará and Maranham, sometimes from Rio de Janeiro and less often from Trinidad, Demerara, Cartagena, and Angostura; it is also shipped from Maracaibo in Venezuela. It often reaches England by way of Havre or New York.

Uses—Copaiba is employed in medicine on account of its stimulant action on the mucous membranes, more especially those of the urinary genital organs.

Adulteration—Copaiba is not unfrequently fraudulently tampered with before it reaches the pharmaceutist; and owing to its naturally

ariable composition, arising in part from its diverse botanical origin, its arity is not always easily ascertained.

The oleo-resin usually dissolves in a small proportion of absolute cohol: should it refuse to do so, the presence of some fatty oil other an castor oil may be surmised. To detect an admixture of this latter, e part of the balsam should be heated with four of spirit of wine p. gr. ·838). On cooling, the mixture separates into two portions, the per of which will contain any castor oil present, dissolved in alcohol d the essential oil. On evaporation of this upper layer, castor oil ay be recognized by its odour; but still more positively by heating it ith caustic soda and lime, when œnanthol will be formed, the presence which may be ascertained by its peculiar smell. By the latter test admixture of even one per cent. of castor oil can be proved.

The presence of fatty oil in any considerable quantity is likewise ade evident by the greasiness of the residue, when the balsam is prived of its essential oil by prolonged boiling with water.

It has been pointed out by Tomlinson,[1] that the figure presented by drop of copaiba balsam on the surface of water is extremely characristic, and readily distinguishable from that of a mixture of the balsam d castor oil. We have not ascertained to what extent this test is pable of practical application.

The admixture of some volatile oil with copaiba can mostly be tected by the odour, especially when the balsam is dropped on a piece warmed metal. Spirit of wine may also be advantageously tried r the same purpose. It dissolves but very sparingly the volatile oil copaiba: the resins of the latter are also not abundantly soluble it. Hence, if shaken with the balsam, it would remove at once the ger portion of any essential oil that might have been added. For e recognition of Wood Oil if mixed with copaiba, see next page, te 1.

Substitutes—Under this head two drugs deserve mention, namely *arjun Balsam* or *Wood Oil*, described at p. 81, and

Oleo-resin of Hardwickia pinnata Roxb.—The tree which is of large size belongs to the order *Leguminosæ* and is nearly related to *paifera*. According to Beddome,[2] it is very common in the dense ist forests of the South Travancore Ghats, and has also been found in uth Canara. The natives extract the oleo-resin in exactly the same thod as that followed by the aborigines of Brazil in the case of paiba,—that is to say, they make a deep notch reaching to the heart the trunk, from which after a time it flows out.

This oleo-resin which has the smell and taste of copaiba, but a much ker colour, was first examined by one of us in 1865, having been sent m the India Museum as a sample of Wood Oil; it was subsequently warded to us in more ample quantity by Dr. Bidie of Madras. It is thick, viscid fluid, which, owing to its intense tint, looks black when n in bulk by reflected light; yet it is perfectly transparent. Viewed in hin layer by transmitted light, it is light *yellowish-green*, in a thick per *vinous-red*,—hence is dichromic. It is not fluorescent, nor is it latinized or rendered turbid by being heated to 130° C., thus differing

[1] *Pharm. Journ.* v. (1864) 387. 495. with ms.

[2] *Flora Sylvatica for Southern India*, Madras, part 24 (1872), 255.

from Wood Oil.[1] Broughton[2] who has investigated it chemic obtained by prolonged distillation with water an essential oil tc extent of 25 per cent. from an old specimen, and of more than 4(cent., from one recently collected. The oil was found to have the composition as that of copaiba, to boil at 225° C., and to rotate the of polarization to the left. The resin is probably of two kinc which one at least possesses acid properties. Broughton made attempts, but without success, to obtain from the resin cryst copaivic acid.

The balsam of *Hardwickia* has been used in India for gonorrhœ with as much success as copaiba.

GUMMI ACACIÆ.

Gummi Arabicum; Gum Arabic; F. *Gomme Arabique;* G. *Arab Gummi, Acacien-Gummi, Kordofan Gummi.*

Botanical Origin—1. *Acacia Verek* Guillemin et Perrottet, a tree, not higher than 20 feet, growing abundantly on sandy sc Western Africa, chiefly north of the river Senegal, where it const extensive forests. It is called by the negroes *Verek*. The same t likewise found in Southern Nubia, Kordofan, and in the region (Upper Atbara in Eastern Africa, where it is known as *Hashab*. *Verek* has a greyish bark, the inner layers of which are strongly fi small yellowish flowers densely arranged in spikes 2 to 3 inches lon exceeding the bipinnate leaves, and a broad legume 3 to 4 inches in l containing 5 to 6 seeds.

According to Schweinfurth,[3] it is this tree exclusively that yiel fine white gum of the countries bordering the Upper Nile and espe of Kordofan.

2. *A stenocarpa* Hochst., a large tree of Southern Nubia Abyssinia, called *Talch, Talha* or *Kakul*, affords a brownish gum which is extensively collected in the district of Gedaref, betwe Blue Nile and the Upper Atbara (about 14° N. lat.).

3. *A Seyal* Delile, var. *Fistula* (*A. Fistula* Schweinf.) a tree of 4 high called *Soffar*, the branches of which are covered with a very pale y bark[4] beset with large milk-white spines, many of which are cur dilated at the base by the puncture of an insect. It grows in Se

[1] It may be further distinguished from Wood Oil as well as from copaiba, if tested in the following simple manner.—Put into a tube 19 drops of bisulphide of carbon and one drop of the oleo-resin, and shake them together. Then add one drop of a mixture of equal parts of strong sulphuric and nitric (1·42) acids. After a little agitation the appearance of the respective mixtures will be as follows:—

Copaiba—Colour faint reddish-brown, with deposit of resin on sides of tube.

Wood Oil—Colour intense purplish-red, becoming violet after some minutes.

Oleo-resin of Hardwickia—No perceptible alteration; the mixture pale greenish yellow.

By this test the presence in copaiba of one-eighth of its volume of Wood Oil easily shown.

[2] Beddome, *op. cit.*

[3] *Aufzählung und Beschreibung d cien-Arten des Nilgebiets.—Linnæa* i 308-376, with 21 plates. Schwei observations are strongly confirme recent account of the commerce of K in the *Zeitschrift f. Erdkunde*, ii. 474. We have adopted in the m species the views taken by Oliver *Flora of Tropical Africa* ii. (1871) 3

[4] The outer bark of the youngest b is of a rusty tint as in the common *A. Seyal*, but it soon exfoliates lea branches nearly white.

:hern Nubia, producing an inferior brownish gum of the same on as the preceding.

arabica Willd. (*A. vera* Willd., *A. nilotica* Delile). This tree under described by Delile as *A. nilotica*, distinguished by having the *glabrous* instead of *tomentose*, is largely planted in the valley of throughout the whole of Egypt and Nubia, where it is known ame of *Sont*. On the banks of the White and Blue Nile and ıern Nubia, it occurs in primæval forests. Schweinfurth, who t as a distinct species, states that it affords a very scanty amount which though collected for use in the country, is nowhere an f trade.

tree is widely distributed in Africa, occurring on the west side negambia and the Niger to Angola; and on the east from the the Nile to Abyssinia, Mozambique and Natal.[1] It is supposed source of the gum exported from Fezzan and Morocco.

rabica is the *Kikar* of the Punjab, the *Babul* or *Babur* of Central Cultivated or self-sown, it is found throughout the greater part ninsula, excepting the most humid coast-regions, and the extreme st beyond the Jhelam, where the winter frost is too severe. In tricts of Sindh and Guzerat where it forms entire forests, the ports the lac-insect. Gum is abundantly exuded from its bark, h that of other trees, forms a portion of the *East India Gum* f commerce.[2]

. *horrida* Willd. (*A. Capensis* Burch.) a large tree, the *Doornboom*, rn or *Karródoorn* of the Cape colonists, is the well-ascertained f the chief portion of the South African gum arabic. It is the est tree of the lonely deserts of South Africa.

ycnantha Benth.; *A. decurrens* Willd. (*A. mollissima* Willd.), the *Green Wattle-tree* of the colonists; *A. dealbata* Link, the *Silver* and *A. homalophylla* A. Cunn., are the trees which furnish the bic of Australia.[3]

tory—The history of this drug carries us back to a remote anti- The Egytian fleets brought gum from Arabia as early as the 17th B.C. Thus in the treasury of king Rhampsinit (Ramses III.) at Abu, there are representations of gum-trees, together with heaps The symbol used to signify *gum*, is read *Kami-en-punt*. i.e. *gum rabia*, and is of frequent occurrence in Egyptian inscriptions; es mention is made of gum from Canaan. The word *kami* is the of the Greek κόμμι, whence through the Latin our own word *gum*.[4] Egyptians used gum largely in painting: an inscription exists tates that in one particular instance a solution of *kami* (gum) was render adherent the mineral pigment called *chestcb*,[5] the name to lapis lazuli or to a glass coloured blue by cobalt.

r. *B. Krauseiana* Benth.—Harvey r, *Flor. Capens.* ii. (1861-2) 281. ia, *Forest Flora of North-Western d India*, Lond. 1874. 181.—It must e borne in mind that a large pro- the gum shipped from Bombay is e of Eastern Africa.

rian Exhibition, 1861.—Report on Indigenous Vegetable Substances), n, 1862, 58.

[4] We have to thank Professor Dümichen for most of the information relating to Egypt, which may be partly found in his own works, and partly in those of Brugsch, Ebers, and Lepsius.

[5] Lepsius, *Abhandl. der Akademie der Wissensch. zu Berlin* for 1871, p. 77. 126. Metalle in den Aegyptischen Inschriften.

Turning to the Greeks, we find that Theophrastus in the 3rd a 4th century B.C. mentioned Κόμμι as a product of the Egyptian Ἄκανθα which tree there was a forest in the Thebaïs, of Upper Egypt. Str also, in describing the district of Arsinöe, the modern Fayûm, says t gum is got from the forest of the Thebaïc *akanthe.*

Celsus in the 1st century mentions *Gummi acanthinum ;* Dioscor and Pliny also describe Egyptian gum, which the latter values a *denarii* [2*s.*] per lb.

Gum was employed by the Arabian physicians and by those of school of Salerno, yet its utility in medicine was but little apprecia and its value in the arts quite ignored until a much later period. Du the middle ages, the small supplies that reached Europe were proc through the Italian traders, from Egypt and Turkey. Thus Pegolo who wrote a work on commerce about A.D. 1340, speaks of gum arabi one of the drugs sold at Constantinople by the *pound,* not by the *qua* Again in a list of drugs liable to duty at Pisa in 1305,[2] and in a sim list relating to Paris in 1349,[3] we find mention of gum arabic, l likewise named by Pasi,[4] in 1521, as an export from Venice to Lond

Gum also reached Europe from Western Africa, with which re the Portuguese had a direct trade as early as 1449.

Production—Respecting the origin of gum in the tribe *Acacie* observations have been made similar to those of H. von Mohl on tr canth.

It appears that gum generally exudes from the trees spontaneo in sufficient abundance to render wounding the bark superfluous. Somali tribes of East Africa however, are in the habit of promoting outflow by making long incisions in the stem and branches of the t In Kordofan the lumps of gum are broken off with an axe, and colle in baskets.

The most valued product called *Hashabi* gum, from the provin Dejara in Kordofan, is sent northward from Bara and El Obei Dabbeh on the Nile, and thence down the river to Egypt; or it rea the White Nile at Mandjara.

A less valuable gum known as *Hashabi el Jesire,* comes from Sen on the Blue Nile; and a still worse from the barren table-lan Takka, lying between the eastern tributaries of the Blue Nile and Atbara and Mareb; and from the highlands of the Bisharrin A between Khartum and the Red Sea. This gum is transported by wa Khartum or El Mekheir (Berber), or by Suakin on the Red Sea. He the worst kind of gum is known in Egypt as *Samagh Savakumi* (*Su Gum*).

According to Munzinger, a better sort of gum is produced along Samhara coast towards Berbera, and is shipped at Massowa. Son it reaches Egypt by way of Jidda, which town being in the distri Arabia called the Hejaz, the gum thence brought receives the nam *Samagh Hejazi ;* it is also called *Jiddah* or *Gedda Gum.* The gum

[1] *Della Decima e di varie altre gravezze imposte dal commune di Firenze,* iii. (1766) 18.

[2] Bonaini, *Statuti inediti della città di Pisa,* Firenze, iii. (1857) 106. 114.

[3] *Ordonnances de Rois de France,* ii. (318.

[4] *Tariffa de pesi e misure,* Venet. 204.

[5] Vaughan (Drugs of Aden), *J Journ.* xii. (1853) 226.

Zeila, Berbera and the Somali country about Gardafui, are shipped to Aden, or direct to Bombay. A little gum is collected in Southern Arabia, but the quantity is said to be insignificant.[1]

In the French colony of Senegal, gum, which is one of its principal productions, is collected chiefly in the country lying north of the river, by the Moors who exchange it for European commodities. The gathering commences after the rainy season in November when the wind begins to set from the desert, and continues till the month of July. The gum is shipped for the most part to Bordeaux. The quantity imported into France in 1870 from Senegal, was 2,862,669 kilo. (107,116 cwt.), value 5,439,076 francs[2] (£217,563).

Description—Gum arabic does not exhibit any very characteristic forms like those observable in gum tragacanth. The finest white gum of Kordofan, which is that most suitable for medicinal use, occurs in lumps of various sizes from that of a walnut downwards. They are mostly of ovoid or spherical form, rarely vermicular, with the surface in the unbroken masses, rounded,—in the fragments, angular. They are traversed by numerous fissures, and break easily and with a vitreous fracture. The interior is often less fissured than the outer portion. At 100° C. the cracks increase, and the gum becomes extremely friable. In moist air, it slowly absorbs about 6 per cent. of water.

The finest gum arabic is perfectly clear and colourless; inferior kinds have a brownish, reddish or yellowish tint of greater or less intensity, and are more or less contaminated with accidental impurities such as bark. The finest white gum turns black and assumes an empyreumatic taste, when it is kept for months at a temperature of about 98° C., either in an open vessel, or enclosed in a glass tube, after having been previously dried over sulphuric acid or not.

An aqueous solution of gum deviates the plane of polarization 5° to the left in a column 50 mm. long; but after being long kept, it becomes strongly acid, the gum having been partly converted into sugar, and its optical properties are altered. An alkaline solution of cupric nitrate is not reduced by solution of gum even at a boiling heat, unless it contains a somewhat considerable proportion of sugar, extractable by alcohol, or a fraudulent admixture of dextrin.

We found the sp. gr. of the purest pieces of colourless gum dried in the air at 15° C., to be 1·487; but it increases to 1·525, if the gum is dried at 100°.

The foregoing remarks apply chiefly to the fine white gum of Kordofan, the *Picked Turkey Gum* or *White Sennaar Gum* of druggists. The other sorts which are met with in the London market are the following:—

1. *Senegal Gum*—As stated above, this gum is an important item of the French trade with Africa, but it is not much used in England. Its colour is usually yellowish or somewhat reddish, and the lumps, which are of large size, are often elongated or vermicular. Moreover Senegal gum never exhibits the numerous fissures seen in Kordofan gum, so that the masses are much firmer and less easily broken. In every other respect, whether chemical or optical, we find[3] Senegal gum

[1] Vaughan, l.c.

[2] *Tableau général du Commerce de la France*, 1870, published 1872.

[3] Flückiger, in the *Jahresbericht* of Wiggers and Husemann, 1869. 149.

and Kordofan gum to be identical; and the two, notwithstanding their different appearance, are produced by one and the same species of *Acacia*, namely *Acacia Verek*.

2. *Suakin Gum, Talca* or *Talha Gum*, yielded by *Acacia stenocarpa*, the *Talch* or *Talha* of the Arabs, and by *A. Seyal* var. *Fistula*, is remarkable for its brittleness, which occasions much of it to arrive in the market in a semi-pulverulent state. It is a mixture of nearly colourless and of brownish gum, with here and there pieces of a deep reddish-brown. Large tears have a dull opaque look, by reason of the innumerable minute fissures which penetrate the rather bubbly mass. It is imported from Alexandria.

3. *Morocco, Mogador* or *Brown Barbary Gum*—consists of tears of moderate size, often vermiform, and of a rather uniform, light, dusky brown tint. The tears which are internally glassy become cracked on the surface and brittle if kept in a warm room; they are perfectly soluble in water.

Gums of various kinds, including the resin Sandrac, were exported from Morocco in the year 1872 to the extent of 5110 cwt., a quantity much below the average.[1]

4. *Cape Gum*—This gum which is uniformly of an amber brown is produced in plenty in the Cape Colony, as a spontaneous exudation of *Acacia horrida* Willd. The *Blue Book* of the Cape Colony published in 1873, states the export of gum in 1872, as 101,241 lb.

5. *East India Gum*—The best qualities consist of tears of various sizes, sometimes as large as an egg, internally transparent and vitreous of a pale amber or pinkish hue, completely soluble in water. This gum is largely shipped from Bombay, but is almost wholly the produce of Africa; the imports into Bombay from the Red Sea ports, Aden and the African Coast in the year 1872–73, were 14,352 cwt. During the same year the shipments from Bombay to the United Kingdom, amounted to 4,561 cwt.[2]

6. *Australian Gum, Wattle Gum*—This occurs in large hard globular tears and lumps, occasionally of a pale yellow, yet more often of an amber or of a reddish-brown hue. It is transparent and entirely soluble in water; the mucilage is strongly adhesive, and said to be less liable to crack when dry than that of some other gums. The solution, especially that of the darker and inferior kinds, contains a little tannin, evidently derived from the very astringent bark which is often attached to the gum. A variety of Australian Gum, unknown to us, is described as having "an amorphous white appearance," owing to the infinite multitude of cracks with which the tears are intersected.

Chemical Characters and Composition—At ordinary temperatures gum dissolves very slowly and without affecting the thermometer in an equal weight of water, forming a thick, glutinous, slightly opalescent liquid, having a mawkish taste and decidedly acid reaction

[1] *Consular Reports*, August, 1873. 917.

[2] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1872–73, pt. ii. 34. 77.

[3] A sample of fine white gum was recently sent to us by a druggist on account of this curious character,—that it gave a solution which was *glairy*, like the mucilage of marshmallow, but in no other respect could we find that it differed from ordinary gum. On exposing it for some days to a temperature of 95° C., it afforded a solution of the usual character.

r temperatures the dissolution of gum is but slightly accele-
l water does not take up a much larger quantity even at 100° C.
t gum dried at 100° C., forms with 2 parts of water a mucilage
1·149 at 15°C.

solution mixes with glycerin, and the mixture may be evaporated
nsistence of a jelly without any separation taking place. Solid
lumps on the contrary, is but little affected by concentrated
In other liquids, gum is insoluble or only slightly soluble,
ere is a considerable quantity of water present. Thus 100
spirit of wine containing 22 volumes per cent. of alcohol,
57 parts of gum; spirit containing 40 per cent. of alcohol
10 parts, and spirit of 50 per cent. only 4 parts. Aqueous
f 60 per cent. no longer dissolves gum, but extracts from it a
antity ($\frac{1}{3}$ to $\frac{1}{4}$ per cent. according to the variety) of resin,
matter, glucose, calcium chloride, and other salts.

al acetate of lead does not precipitate gum arabic mucilage;
asic acetate forms even in a very dilute solution, a precipitate
e constitution.

le silicates, borates, and ferric salts render gum solution turbid,
n it to a jelly. It is not a compound of gum with any of these
s which is formed, but in the case of the first, basic silicates
No alteration is produced by silver salts, mercuric chloride or
mmonium oxalate throws down the lime contained in a solution
Gum dissolves in an ammoniacal solution of cupric oxide.
on by nitric acid, mucic acid is produced.

l, air-dried lumps of gum lose by desiccation at 100° C., 12 to
nt. of water. If gum independently of its amount of lime, be
ed by the formula $C^{12}H^{22}O^{11}$, $3H^2O$, the loss of 3 molecules of
ll correspond to a decrease in weight of 13·6 per cent.; in
selected colourless pieces, we have found it to amount to 13·14
. At a temperature of about 150° C., gum parts with another
of water, and loses its solubility.

gum arabic is dissolved in cold water and the solution is
acidulated with hydrochloric acid, alcohol produces in it a
te of *Arabin* or *Arabic Acid*. It may be also prepared by
solution of gum (1 gum + 5 water), acidulated with hydrochloric
dialyser, when the calcium salt will diffuse out, leaving behind
of arabin.

ion of arabin differs from one of gum, in not being precipitated
l. Having been dried, it loses its solubility, merely swelling in
t not dissolving even at a boiling heat. If an alkali is added,
a solution like ordinary gum. Neubauer who observed these
54–57), showed that gum arabic is essentially an acid calcium
abic acid.

ic Acid dried at 100° C., has the composition $C^{12}H^{22}O^{11}$, and gives
when it unites with bases. It has however a great tendency
alts containing several equivalents of acid to one of base. An
ium arabate of the composition $C^{12}H^{20}CaO^{11}$, $6C^{12}H^{22}O^{11}$, would
·63 per cent. of calcium, corresponding to 3·4 per cent. of calcium
. Such salts have been prepared by Neubauer and also by
jer.

most carefully selected colourless pieces of gum arabic, yield from

2·7 to 4 per cent. of ash, consisting mainly of calcium carbonate, but containing also carbonates of potassium and magnesium. Phosphoric acid appears never to occur in gum.

Natural gum may therefore be regarded as a salt of arabic acid having a large excess of acid, or perhaps as a mixture of such salts of calcium, potassium and magnesium. It is to the presence of these bases, which are doubtless derived from the cell-wall from which the gum exuded, that gum owes its solubility.

It still remains unexplained why certain gums, not unprovided with mineral constituents, merely swell up in water without dissolving, thus materially differing from gum arabic. There is also a marked difference between gum arabic and many other varieties of gum or mucilage, which immediately form a plumbic compound if treated with neutral acetate of lead. The type of the swelling but not really soluble gums, is *Bassora Gum*[1] (p. 156); but there are a great many other substances of the same class.[2]

Commerce—The recent imports of Gum Arabic into the United Kingdom have been as follows :—

1871	1872
76,136 cwt., value £250,088.	42,837 cwt., value £123,080.

The country whence by far the largest supplies are shipped, is Egypt.

Uses—Gum is employed in medicine rather as an adjuvant than as possessing any remedial powers of its own.

Substitutes—*Feronia Gum.* This is the produce of *Feronia Elephantum* Correa, a spiny tree, 50 to 60 feet high, of the order *Aurantiaceæ*, common throughout India from the hot valleys of the Himalaya to Ceylon, and also found in Java. There exudes from its bark, abundance of gum which appears not to be collected for exportation *per se*, but rather to be mixed indiscriminately with other gum, as that of *Acacia*.

Feronia gum sometimes forms small roundish transparent, almost colourless tears, more frequently stalactitic or knobby masses, of a brownish or reddish colour, more or less deep. In an authentic sample, for which we are indebted to Dr. Thwaites of Ceylon, horn-shaped pieces about ½ an inch thick and 2 inches long, also occur.

Dissolved in two parts of water, it affords an almost tasteless mucilage, of much greater viscosity than that of gum arabic made in the same proportions. The solution reddens litmus, and is precipitated like gum arabic by alcohol, oxalate of ammonium, alkaline silicates, perchloride of iron, but not by borax. Moreover, the solution of Feronia gum is precipitated by neutral acetate of lead or caustic baryta, but not by potash. If the solution is completely precipitated by neutral acetate of lead, the residual liquid will be found to contain a small quantity of a different gum, identical apparently with gum arabic, inasmuch as it is not thrown down by acetate of lead. If the lime is precipitated from the Feronia mucilage by oxalate of potassium, the gum partially loses its solubility and forms a turbid liquid.

From the preceding experiments, it follows that the larger portion of Feronia gum is by no means identical with gum arabic. The former

[1] Guibourt, *Hist. des Drogues*, iii. (1850) 421.

[2] For further information, see Wiesner, *Gummiarten, Harze u. Balsame*, Erlangen, 1869; Flückiger, *Pharm. Journ.* x. (1869) 641.

ien examined in a column of 50 mm. length, deviates the ray of larized light 0°·4 to the right,—not to the *left* as gum arabic. Gum abic may be combined with oxide of lead; the compound (arabate of ad) contains 30·6 per cent. of oxide of lead, whereas the plumbic mpound of Feronia gum, dried at 110° C., yielded us only 14·76 per nt. of PbO. The formula, $C^{12}H^{2}PbO^{11} + 3C^{12}H^{11}O^{11}$, supposes 15 per nt. of oxide of lead.[1] $2(C^{12}H^{21}O^{11})M + 2(C^{12}H^{22}O^{11})$

Feronia gum repeatedly treated with fuming nitric acid, produces bundant crystals of mucic acid. We found our sample of the gum to ield 17 per cent. of water, when dried at 110° C. It left 3·55 per cent. f ash.

CATECHU.

techu nigrum; Black Catechu, Pegu Catechu, Cutch, Terra Japonica; F. *Cachou, Cachou brun ou noir;* G. *Catechu.*

Botanical Origin—The trees from which this drug is manufactured e of two species, namely:—

1. *Acacia Catechu* Willd. (*Mimosa Catechu* L. fil., *M. Sundra* Roxb.[2]), tree 30 to 40 feet high, with a short, not very straight trunk 4 to 6 et in girth, straggling thorny branches, light feathery foliage, and dark ey or brown bark, reddish and fibrous internally.

It is common in most parts of India and Burma, where it is highly lued for its wood which is used for posts and for various domestic rposes, as well as for making catechu and charcoal, while the astrinnt bark serves for tanning. It also grows in the hotter and drier rts of Ceylon. *A. Catechu* abounds in the forests of Tropical Eastern frica; it is found in the Soudan, Sennaar, Abyssinia, the Noer country, d Mozambique, but in none of these regions is any astringent extract anufactured from its wood.

2. *A. Suma* Kurz[3] (*Mimosa Suma* Roxb.), a large tree with white rk, nearly related to the preceding but not having so extensive a ographical range. It grows in the South of India (Mysore), Bengal, d Guzerat. The bark is used in tanning, and catechu is made from e heart-wood.

The extract of the wood of these two species of *Acacia* is *Catechu* the true and original sense of the word, a substance not to be conunded with *Gambier*, which though very similar in composition, is dely diverse in botanical origin, and always regarded in commerce as listinct article.

History—Barbosa in his description of the East Indies in 1514[4] ntions a drug called *Cacho* as an article of export from Cambay to dacca. This is the name for *Catechu* in some of the languages of rthern India.[5]

About fifty years later, Garcia d'Orta gave a particular account of

We obtained 14·56 and 14·96 per cent. PbO.—Pb = 207.

Some Indian botanists, as Beddome, re- Mimosa (*Acacia*) *Sundra* as distinct *A. Catechu*.

Brandis, *Forest Flora of North-Western Central India*, Lond. 1874. 187, from which excellent work we also borrow the description of *A. Catechu*.

[4] Published by the Hakluyt Society, Lond. 1866. p. 191.

[5] As Tamil and Canarese, in which according to modern spelling the word is written *Kâshu* or *Kâchu*.—Moodeen Sheriff, *Suppl. to Pharmacopœia of India*, 1869. 96.

the same drug[1] under its Hindustani name of *Kat*, first describin tree and then the method of preparing an extract from its wood. latter substance was at that period made up with the flour of a ((*Eleusine coracana* Gärtn.) into tablets or lozenges, and apparentl sold in its simple state: compositions of this kind are still met w India. In the time of d'Orta the drug was an important arti traffic to Malacca and China, as well as to Arabia and Persia.

Notwithstanding these accounts, catechu remained unknov Europe until the latter half of the 17th century, when it began brought from Japan. Schröder in the 4th edition of his *Pharma Medico-Chymica* published at Lyons in 1654, briefly describes *Catechu* or *Terra Japponica*,—"*genus terræ exoticæ*," of which he little bit had been given to him by the druggist, Matthew Bansa.

In 1671, catechu was noticed as a useful medicine by G. W. of Jena,[2] who also called attention to the diversity of opinion a mineral or vegetable nature. Schröck[3] in 1677 combated the no its mineral origin, and gave reasons for considering it a vegetab stance. A few years later, Cleyer[4] who had a personal knowle China, pointed out the enormous consumption of catechu for mast in the East,—that it is imported into Japan,—that the best com Pegu, but some also from Surat, Malabar, Bengal, and Ceylon.

Catechu was received into the London Pharmacopœia of 17 was even then placed among "*Terræ medicamentosæ*."

The wholesale price in London in 1776 was £16 16*s.* per c 1780 £20; in 1793 £14 14*s.*, from which it is easy to infer tl consumption could only have been very small.[5]

Manufacture—Cutch, commonly called in India *Kát* or *Ku* aqueous extract made from the wood of the tree. The process f paring it varies slightly in different districts.

The tree is reckoned to be of proper age when its trunk i a foot in diameter. It is then cut down, and the whole of the part, with the exception of the smaller branches and the bark, is c into chips. Some accounts state that only the darker heart-wood used. The chips are then placed with water in earthen jars, a s which is arranged over a mud-built fire-place, usually in the o Here the water is made to boil, the liquor as it becomes thick anc being decanted into another vessel, in which the evaporation tinued until the extract is sufficiently inspissated, when it is into moulds made of clay, or of leaves pinned together in the s cups, or in some districts on to a mat covered with the ashes dung, the drying in each case being completed by exposure to and air. The product is a dark brown extract, which is the usu in which cutch is known in Europe.

In Kumaon in the north of India,[6] a slight modification process affords a drug of very different appearance. Instead of

[1] *Aromatum Historia*, ed. Clusius, 1574. 44.—He writes the word *Cate*.

[2] *Usus novus Catechu seu Terræ Japonicæ*, —*Ephemerides Nat. Cur.*, Dec. i. ann. 2 (1671) 209.

[3] Ibid. Dec. i. ann. 8 (1677) 88.

[4] Ibid. Dec. ii. ann. 4 (1685). 6.

[5] Pegu Cutch is quoted in a Lon current, 21 Aug. 1873, 18*s.* to 20*s.*

[6] Madden in *Journ. of Asia. Bengal*, xvii. part i. (1848) 565; a communication accompanied by of tree, wood, and extract fro E. G. Matthews, of the Kum Works, Nynee Tal.

ıg the decoction to the condition of an extract, the inspissation is ped at a certain point and the liquor allowed to cool, "coagulate," crystallize over twigs and leaves thrown into the pots for the pur-. How this drug is finished off we do not exactly know, but we told that by this process there is obtained from each pot about 2 lb. *Kath*" or catechu, of an ashy whitish appearance, which is quite in rdance with the specimens we have received and of which we shall k further on.

In Burma the manufacture and export of cutch form, next to the of timber, the most important item of forest revenue. According report by the Commissioner of the Prome Division, the trade returns 869–70, show that the quantity of cutch exported from the province ng the year was 10,782 tons, valued at £193,602, of which nearly half was the produce of manufactories situated in the British terri-. Vast quantities of the wood are consumed as fuel, especially for steamers on the Irrawadi.[1]

Description—Cutch is imported in mats, bags, or boxes. It is a brown, extractiform substance, hard and brittle on the surface of nass, but soft and tenacious within, at least when newly imported. large leaf of *Dipterocarpus tuberculatus* Roxb., the *Ein* or *Engben* ıe Burmese, is often placed outside the blocks of extract.

'utch when dry breaks easily, showing a shining but bubbly and tly granular fracture. When it is soft and is pulled out into a thin it is seen to be translucent, granular and of a bright orange-brown. n further moistened and examined under the microscope, it exhibits bundance of minute acicular crystals, precisely as seen in gambier. ıave observed the same in numerous samples of the dry drug when ·red pulpy by the addition of water, or moistened with glycerin ·iewed by polarized light.

he pale cutch referred to as manufactured in the north of India, is e form of irregular fragments of a cake an inch or more thick, which laminated structure and appears to have been deposited in a round-med vessel. It is a porous, opaque, earthy-looking substance of e pinkish brown, light, and easily broken. Under the microscope ıeen to be a mass of needle-shaped crystals exactly like gambier, which in all essential points it corresponds. We have received India the same kind of cutch made into little round cakes like ges, with apparently no addition. The taste of cutch is astringent, red by a sensation of sweetness by no means disagreeable.

hemical Composition—Extractiform cutch, such as that of Pegu, ı is the only sort common in Europe, when immersed in cold water whitish, softens and disintegrates, a small proportion of it dis-ıg and forming a deep brown solution. The insoluble part is *kin* or *Catechuic Acid*, in minute acicular crystals. If a little of hick chocolate-like liquid made by macerating cutch in water, is d to the boiling point, it is rendered quite transparent (mechanical ıties being absent), but becomes turbid on cooling. Ferric chloride with this solution a dark green precipitate, immediately changing rple if common water or a trace of free alkali be used; dilute throw down a precipitate.

ırson (G. F.) *Report of the Adminis- of the Forest Department in the several provinces under the Government of India*, 1871-72, Calcutta 1872, part 5. p. 22,

Ether extracts from cutch, catechin. This substance has been shown by Rochleder (1869) to have the formula $C^{13}H^{12}O^5$, and to be a compound of *Phloroglucin*, $C^6H^6O^3$, and *Æscylic Alcohol*, $C^7H^8O^3$, less H^2O. Catechin dehydrated by drying over oil of vitriol, and then treated with an acid, loses H^2O and is converted into brown, amorphous *Catechuretin.*

An aqueous solution of catechin does not precipitate a solution, either of gelatin, emetic tartar, or of a vegetable alkaloid; but the precipitation at least of the first-mentioned, takes place if the catechin solution is previously boiled for a long time, the result in this case being due to the partial conversion of the catechin into *Catechu-tannic Acid.* The latter substance is also extracted when cutch or gambier is exhausted with cold water, but from the difficulty of obtaining it free from catechin it has not been thoroughly examined.[1]

Löwe (1873)[2] by exhausting cutch with cold water and then agitating the solution with ether, obtained upon the evaporation of the latter, a yellow crystalline substance which he ascertained to be *Quercetin*, $C^{27}H^{18}O^{12}$. Its solubility in water is probably favoured by the presence of catechin, water having but very little action upon pure quercetin. The amount of quercetin in cutch is exceedingly small.

When either cutch or gambier is subjected to dry distillation it yields, in common with many other substances, *Pyrocatechin*, $C^6H^6O^2$.

Commerce—The importations of cutch into the United Kingdom from British India (excluding the Straits Settlements and Ceylon) were as under, almost the whole being from Bengal and Burma:—

1869	1870	1871	1872
2257 tons.	5252 tons.	4335 tons.	5240 tons.

The total value of the cutch imported in 1872, was estimated at £124,458.

Uses—Cutch under the name of *Catechu*, which name it shares with gambier, is employed in medicine as an astringent.

Analogous Product—*Areca-nut Catechu*—The seeds of *Areca Catechu* L., the most elegant palm of India, are called *Areca Nuts* or *Betel Nuts*, and yield when boiled in water, an astringent extract which was once supposed to form part of the catechu of commerce; but there is no reason to believe that any of it now finds its way to Europe. Drury[3] states it to be a catechu of very inferior quality, one variety of which, called *Cuttacamboo* (*Katta Kámbu*) is chewed with lime and betel-leaf.

ROSACEÆ.

AMYGDALÆ DULCES.

Sweet Almonds; F. *Amandes douces;* G. *Süsse Mandeln.*

Botanical Origin—*Prunus Amygdalus* Baillon[4] var. *β dulcis* (*Amygdalus communis* L. var. *β dulcis* DC.)—The native country of the almond cannot be ascertained with precision. A. de Candolle[5] after

[1] Gmelin, *Chemistry*, xv. (1862) 515.
[2] Fresenius, *Zeitschrift für anal. Chemie*, xii. (1873) 127.
[3] *Useful Plants of India*, 2nd ed., 1873. 48.
[4] *Hist. des Plantes* (*Monogr. des Rosacées*, 1869) i. 415.
[5] *Géographie Botanique*, ii. (1855) 888.

the statements of various authors concerning the occurrence
ɜ in an apparently wild state, arrives at the conclusion that
ɩl area possibly extended from Persia, westward to Asia Minor
, and even to Algeria.
early period the tree was spread throughout the entire Medi-
region, and in favourable situations, far into the continent of
It was apparently introduced into Italy from Greece, where
to Heldreich,[1] the bitter variety is truly wild. The almond-
res its fruit in the south of England, but is liable to destruc-
ost in many parts of central Europe.

ɪry—The earliest notice of the almond extant is that in the
ɪenesis,[2] where we read that the patriarch Israel commanded
o carry with them into Egypt, a present consisting of the pro-
ɔf Palestine, one of which is named as *Almonds.*
the copious references to the almond in the writings of Theo-
one cannot but conclude that in his day it was familiarly

ly, M. Porcius Cato[3] mentions towards the middle of the 2nd
.C., *Avellanæ Græcæ* which we know from later authors signified
Columella who wrote about A.D. 60, calls them *Nuces Græcæ.*
ɪonds ("*Amygdali amari*") are named about this latter period
nius Largus, a physician of Rome.
more northern Europe, almonds are mentioned together with
ɜeries and spices as early as A.D. 716, in a charter granted by
II. king of France, to the monastery of Corbie in Normandy.[4]
ɪt century, Charlemagne ordered the trees (*Amandalarii*) to be
d on the imperial farms. In the later middle ages, the cultiva-
e almond was carried on about Speier and in the Rhenish Pala-
Ve learn from Marino Sanuto[5] that in the beginning of the
ury, almonds had become an important item of the Venetian
ɩlexandria. They were doubtless in large part produced by
.s of the Greek Archipelago, then under Christian rule. In
ɔr instance, the Knights Templar levied tithes in 1411, of
ɪoney and sesamé seed.[6]
ɔnsumption of almonds in mediæval cookery was enormous.
tory made in 1372, of the effects of Jeanne d'Evreux, queen
, enumerates only 20 ℔. of sugar, but 500 ℔. of almonds.[7]
: *Form of Cury*, a manuscript written by the master cooks of
hard II., A.D. 1390, are receipts for "*Creme of Almand, Grewel*
d, Cawdel of Almand Mylke, Jowt of Almand Mylke," &c.[8]
ɪds were sold in England by the "*hundred,*" *i.e.* 108 ℔. Rogers[9]
average price between 1259 and 1350 as 2*d.*, and between 1351
as 3½*d.* per ℔.

ɪazen *Griechenlands*, Athen, 1862.

.. v. 11.
'ustica, cap. viii.
ɪa, *Diplomata, Chartæ*, etc. Paris,
.
cretorum Fidelium, ed. Bongars,

Latrie, *Hist. de l'île de Chypre*,
0.

[7] Leber, *Appréciation de la fortune privée au moyen-âge*, éd. 2, Paris, 1847. 95.

[8] Published by Pegge, Lond. 1780.—Boorde in his *Dyetary of Helth*, 1542, mentions *Almon Mylke* and *Almon Butter*, the latter "*a commendable dysshe specyallye in Lent.*"

[9] *Agriculture and Prices in England*, i. (1866) 641.

Description—The fruit of the almond-tree is a drupe, with a vel sarcocarp which at maturity dries, splits, and drops off, leaving and still attached to the branch, an oblong, ovate, pointed stone, pi with irregular holes. The seed, about an inch in length, is ovat oblong, more or less compressed, pointed at the upper, blunt at the l end, coated with a scurfy, cinnamon-brown skin or testa. It is conn with the stone or putamen by a broad funicle, which runs alon edge for more than a third of its length from the apex: hence the r passes downwards to the rounded end of the seed, where a scar n the chalaza. From this, a dozen or more ramifying veins run u brown skin towards the pointed end. After an almond has been r rated in warm water, the skin is easily removed, bringing with i closely attached translucent inner membrane or endopleura. As the is without albumen, the whole mass within the testa consists of em This is formed of a pair of plano-convex cotyledons, within which li flat leafy plumule and thick radicle, the latter slightly projecting the pointed or basal end of the seed.

Almonds have a bland, sweet, nutty flavour. When triturated water, they afford a pure white, milk-like emulsion of agreeable tas

Varieties—The different sorts of almond vary in form and siz more particularly in the firmness of the shell. This in some varie tender and easily broken in the hand, in others so hard as to req hammer to fracture it. The form and size of the kernel likewise e some variation. The most esteemed are those of Malaga, known in as *Jordan Almonds*. They are usually imported without the shel differ from all other sorts in their oblong form and large size. The kinds of sweet almonds known in the London market, are distingu in the order of value as *Valencia*, *Sicily*, and *Barbary*.

Microscopic Structure—Three different parts are to be distingu in the brown coat of an almond. First, a layer of very large (as as $\frac{1}{3}$ mm. in diameter) irregular cells, to which the scurfy surface i If these brittle cells are boiled with caustic soda, they make a bri object for microscopic examination in polarized light. The two layers of the skin are made up of much smaller cells, traversed by fibro-vascular bundles. The brown coat assumes a bluish hu addition of perchloride of iron, owing to the presence of tannic mat

The cotyledons consist of thin-walled parenchyme, fibro-vas bundles being not decidedly developed. This tissue is loaded granular albuminous matter, some of which exhibits a cryst aspect, as may be ascertained in polarized light. Starch is altog wanting in almonds.

Chemical Composition—The sweet almond contains fixe extractable by boiling ether to the extent of 50 to 55 per cent produce of 50 per cent. by the hydraulic press is by no means uncom

The oil (*Oleum Amygdalæ*) is a thin, light yellow fluid, of sp. gr which does not solidify till cooled to between −10 and −20° C. fresh, it has a mild nutty taste, but soon becomes rancid by expos

[1] The result of 10 analyses—Vohl in Dingler's *Polytechn. Journ.* cc. (1871) 410.

[2] Such was the experience in the apotheke at Bern, where sweet almon often pressed.—F. A. F.

it is not however one of the drying oils. It consists almost wholly ycerin compound of *Oleic Acid*, $C^{18}H^{34}O^{2}$.

onds easily yield to cold water a sugar tasting like honey, which alkaline cupric tartrate even in the cold, and is therefore in pe-sugar. Pelouze however (1855) obtained from almonds 10 of cane-sugar. The amount of gum appears to be very small; 1865) found that the *total amount* of sugar, dextrin and mucilage gether only 6·29 per cent.

almond yields 3·7 per cent. of nitrogen, corresponding to about nt. of albuminoid matters. These have been elaborately examined quet (1837–38), Ortloff (1846), Bull (1849), and Ritthausen The experiments tend to show that there exist in the almond rent protein substances; Robiquet termed one of these bodies e, while others applied to it the name *Emulsin*.[2] Commaille named the second albuminous substance *Amandin;* it is the *legumin* of Gmelin's *Chemistry*, the *Conglutin* of Ritthausen. has not yet been freed from earthy phosphates which, when cipitated by alcohol from an aqueous solution, often amount d of its weight. Amandin may be precipitated from its aqueous by acetic acid. According to Ritthausen, these bodies are to ded as modifications of one and the same substance, namely e casein.

ched almonds comminuted yield when slightly warmed with otash, a small quantity of hydrocyanic acid and of ammonia; er may be made manifest by means of Schönbein's test pointed . 222.

ash of almonds, amounting to from 3 to nearly 5 per cent., con- ly of phosphates of potassium, magnesium and calcium.

luction and Commerce—The quantity of almonds imported United Kingdom in 1872, was 70,270 cwt., valued at £204,592. quantity, Morocco supplied 33,500 cwt., and Spain with the Islands 22,000 cwt., the remainder being made up by Italy, , France, and other countries. Almonds are largely shipped Persian Gulf: in the year 1872-73, there were imported thence nbay, 15,878 cwt., besides 3,049 cwt. from other countries.[3]

s—Sweet almonds may be used for the extraction of almond oil, are but rarely so employed (at least in England) on account of ior value of the residual cake. The only other use of the sweet n medicine, is for making the emulsion called *Mistura Amygdalæ*.

AMYGDALÆ AMARÆ.

Bitter Almonds; F. *Amandes amères;* G. *Bitter Mandeln.*

inical Origin—*Prunus Amygdalus* Baillon var. *a. amara* *lus communis* L. var. *a. amara* DC.) The Bitter Almond tree

Eiweisskörper der Getreidearten, ülse und Oelsamen. Bonn. 1872.

[2] Gmelin, *Chemistry*, xviii. (1871) 452.

[3] *Statement of the Trade and Navigation of Bombay for* 1872-73, pt. ii. 31.

is not distinguished from the sweet by any permanent botanical charact and its area of growth appears to be the same (see p. 216).

History—See preceding article.

Description—Bitter almonds agree in outward appearance, for and structure with sweet almonds; they exist under several varieti but there is none so far as we know, that in size and form resembles t long sweet almond of Malaga.[1] In general, bitter almonds are of small size than sweet. Triturated with water, they afford the same whi emulsion as sweet almonds, but it has a strong odour of hydrocyan acid and a very bitter taste.

Varieties—These are distinguished in their order of goodness, t French, Sicilian, and Barbary.

Microscopic Structure—In this respect, no difference betwe sweet and bitter almonds can be pointed out. If thin slices of the latt are deprived of fat oil by means of benzol, and then kept for some yea in glycerin, an abundance of crystals is slowly formed, of what w suppose to be amygdalin.

Chemical Composition—Bitter almonds when comminuted a mixed with water, immediately evolve the odour of bitter almond o The more generally diffused substances are the same in both kinds o almond, and the fixed oil in particular of the bitter almond is identic with that of the sweet. Bitter almonds however contain on an avera a somewhat lower proportion of oil than the sweet. In one instance th has come to our knowledge in which 28 cwt. of bitter almonds we submitted to pressure, the yield of oil was at the rate of 43·6 per ce Mr. Umney, director of the laboratory of Messrs. Herrings and Co., wh large quantities of bitter almonds are submitted to powerful hydrau pressure, gives 44·2 as the average percentage of oil obtained during t years 1871–2.

As early as the beginning of the present century, it was shown b the experiments of Bohm of Berlin, that the aqueous distillate of bitt almonds contains hydrocyanic acid and a peculiar oil which cannot b obtained from sweet almonds.[2]

Robiquet and Boutron-Charlard in 1830, prepared from bitter almon a crystalline substance, *Amygdalin*, and found that bitter almond oil a hydrocyanic acid can no longer be obtained from bitter almonds, t amygdalin of which has been removed by alcohol. Liebig and Wöh in 1837 showed that it is solely the decomposition of this body (und conditions to be explained presently), that occasions the formation the two compounds above named. Disregarding secondary produ (ammonia and formic acid), the reaction takes place as represented in t following equation:

$$\underset{\text{Anhydrous Amygdalin.}}{C^{20}H^{27}NO^{11}} + \underset{\text{Water.}}{2H^2O} = \underset{\text{Bitter Almond Oil.}}{C^7HO} + \underset{\text{Hydrocyanic Acid.}}{CHN} + \underset{\text{Anhydrous Dextro-glucose.}}{C^{12}H^{24}O^{12}}$$

This memorable investigation first brought under notice a body of t glucoside class, now so numerous.

[1] Hence to avoid bitter almonds being used instead of sweet, the *British Pharmacopœia* directs that *Jordan Almonds* alone shall be employed for Confection of Almonds.

[2] J. B. Richter, *Neuere Gegenstände Chymie*, Breslau, xi. (1802) 65.

ygdalin may be obtained crystallized with $2H^2O$, when almonds l of their oil are boiled with alcohol of 84 to 94 per cent. The amounts at most to 2½ or 3 per cent. Amygdalin *per se* s in 15 parts of water at 8–12° C., forming a neutral, bitter, us liquid, quite destitute of poisonous properties.

en bitter almonds have been freed from amygdalin and fixed oil, ater extracts from the residue chiefly emulsin and another oid matter separable by acetic acid. The emulsin upon addition ol, falls down in thick flocks, which, after draining, form with ter a slightly opalescent solution. This liquid added to an solution of amygdalin, renders it turbid, and developes in it mond oil. The reaction takes place in the same manner, if the has not been previously purified by acetic acid and alcohol, or ulsion of sweet almonds is used. But after boiling, an emulsion nds is no longer capable of decomposing amygdalin.

at alteration the emulsin itself undergoes in this reaction, or it suffers any alteration at all, has not been clearly made out. ction does not appear to take place necessarily in atomic propor- it does not cease until the emulsin has decomposed about ten ts own weight of amygdalin, provided always that sufficient present to hold all the products in solution.

leaves of *Prunus Lauro-cerasus* L., the bark of *P. Padus* L., e organs of many allied plants, also contain emulsin or a ce analogous to it, not yet isolated. In the seeds of various belonging to natural orders not botanically allied to the almond, example in those of mustard, hemp, and poppy, and even in egg, albuminous substances occur which are capable of acting nygdalin in the same manner. Boiling dilute hydrochloric acid the same decomposition, with the simultaneous production of cid.

distillation of bitter almonds is known to offer some difficulties unt of the large quantity present of albuminous substances, which se to bumping and frothing. Michael Pettenkofer (1861) has hat these inconveniences may be avoided by immersing 12 parts of ed almonds in boiling water, whereby the albuminous matters are ted, whereas the amygdalin is dissolved. On then adding an n of only 1 part of almonds (sweet or bitter), the emulsin con- n it will suffice to effect the required decomposition at a tempera- t exceeding 40° C. In this manner, Pettenkofer obtained in some ents performed with small quantities of almonds, as much as cent. of essential oil. In the case alluded to on the opposite which 28 cwt. of almonds were treated, the yield of essential unted to 0·87 per cent. From data obligingly furnished to us by Herrings and Co. of London, who distill large quantities of almond appears that the yield of essential oil is very variable. The verages as taken from the books of this firm, show that it may w as 0·74, or as high as 1·67 per cent., which, assuming 57 pounds as equivalent to 100 pounds of almonds, would represent a per- from the latter of 0·42 and 0·95 per cent. respectively. Mr. explains this enormous variation as due in part to natural ness in the different kinds of bitter almond, and in part to their are with sweet almonds. He also states that the action of the

emulsin on the amygdalin when in contact with water, is extremely rapid, and that 200 pounds of almond marc are thoroughly exhausted by a distillation of only three hours.

In the distillation, the hydrocyanic acid and bitter almond oil unite into an unstable compound. From this, the acid is gradually set free, and partly converted into cyanide of ammonium and formic acid. Supposing bitter almonds to contain 3·3 per cent. of amygdalin, they must yield 0·2 per cent. of hydrocyanic acid. Pettenkofer obtained by experiment as much as 0·25 per cent., Feldhaus (1863) 0·17 per cent.

Some manufacturers supply bitter almond oil deprived of hydrocyanic acid, but such purified oil is very prone to oxidation, unless carefully deprived of water by being shaken with fused chloride of calcium. The sp. gr. of the original oil is 1·061—1·065; that of the purified oil (according to Umney) 1·049. The purification by the action of ferrous sulphate and lime, and re-distillation, as recommended by Maclagan (1853), occasions, we are informed, a loss of about 10 per cent.

There are a great number of plants which if crushed, moistened with water, and submitted to distillation, yield both bitter almond oil and hydrocyanic acid. In many instances the amount of hydrocyanic acid is so extremely small, that its presence can only be revealed by the most delicate test,—that of Schönbein.[1]

Among plants capable of emitting hydrocyanic acid, probably always accompanied with bitter almond oil, the tribes *Pruneæ* and *Pomeæ* of the rosaceous order may be particularly mentioned.

The farinaceous rootstocks of the Bitter Cassava, *Manihot utilissima* Pohl, of the order *Euphorbiaceæ*, the source of tapioca in Brazil, have long been known to yield hydrocyanic acid.

A composite, *Chardinia xeranthemoides* Desf., growing in the Caspian regions, has been shown by W. Eichler also to emit hydrocyanic acid.[2] The same has been observed by the French in Gaboon[3] with regard to the fruits of *Ximenia Americana* L. of the order *Olacineæ*, and the fact has been confirmed by Ernst of Caracas,[4] near which place the plant abounds. Mr. Prestoe of the Botanical Garden, Trinidad, informs us (1874) that in that island a convolvulaceous plant, *Ipomœa dissecta* Willd., contains a juice with a strong prussic acid odour. According to Lösecke, a common mushroom, *Agaricus Oreades* Bolt., emits hydrocyanic acid.[5]

This acid is consequently widely diffused throughout the vegetable kingdom. Yet amygdalin has thus far only been isolated from a few plants belonging to the genus *Prunus* or its near allies.[6] In all other plants in which hydrocyanic acid has been met with, we know nothing as to its origin. Ritthausen and Kreusler[7] have proved the *absence* of amygdalin in the seeds of a *Vicia*, which yield bitter almond oil and hydrocyanic acid. These chemists followed the process which in the case of bitter almonds easily affords amygdalin.

Commerce—See preceding article.

[1] Applied in the following manner:—Let bibulous paper be imbued with a fresh tincture of the wood or resin of guaiacum, and after drying, let it be moistened with a solution composed of one part of sulphate of copper in 2000 of water. Such paper moistened with water will assume an intense blue coloration in the presence of hydrocyanic acid.

[2] *Bull. de la Soc. imp. des nat. de Moscou*, xxxv. (1862) ii. 444.

[3] Exposition Univers. de 1867.—*Produits des Colonies Françaises*, 92.

[4] *Archiv der Pharmacie*, 181 (1867) 222.

[5] *Jahresbericht* of Wiggers and Husemann for 1871. 11.

[6] Gmelin, *Chemistry*, vii. 389; xv. 422.

[7] *Chemisches Centralblatt*, 1871. 3.

:s—Bitter almonds are used almost exclusively for the manu- of *Almond Oil*, while from the residual cake is distilled *Bitter ! Oil.* An emulsion of bitter almonds is sometimes prescribed as .

ılteration—The adulteration of bitter almonds with sweet is a t source of loss and annoyance to the pressers of almond oil, profit largely depends on the amount of volatile oil they are extract from the residual cake.

FRUCTUS PRUNI.

Prunes; F. Pruneaux à médecine.

:anical Origin—*Prunus domestica* L., var. ζ. *Juliana* DC.—It is ıis tree which is known as *Prunier de St. Julien*,[1] that the true ıal *Prunes* of English pharmacy are derived. The tree is largely ed in the valley of the Loire in France, especially about Bourgueil, town lying between Tours and Angers.

ıtory—The plum-tree (*P. domestica* L.) from which it is supposed ıerous cultivated varieties have descended, is believed to occur in wild state in Greece, the south-eastern shores of the Black Sea ın), the Caucasus, and the Elburz range in Northern Persia, from which countries it was introduced into Europe long before the ın era. In the days of Pliny, numerous species of plum were in cultivation, one of which afforded a fruit having laxative ies.

ed prunes, especially those taking their name from Damascus *Damascena*), are frequently mentioned in the writings of the physicians, by whom as well as at a later period by the practitioners Schola Salerni, they were much employed.

the older London pharmacopœias, many sorts of plum are ated, but in the reformed editions of 1746, 1788 and 1809, the Prune (*Prunum Gallicum*) is specially ordered, its chief use s an ingredient of the well-known *Lenitive Electuary;* and this still held by the grocers to be the legitimate *prune*. The same is regarded in France as the prune of medicine.

ıcription—The prune in its fresh state is an ovoid drupe of a ırple hue, not depressed at the insertion of the stalk, and with a visible suture, and no furrow. The pulp is greenish and rather unless the fruit is very ripe; it does not adhere to the stone. ne is short ($\frac{7}{10}$ to $\frac{8}{10}$ of an inch long, $\frac{5}{10}$ to $\frac{6}{10}$ broad), broadly l at the upper end and slightly mucronulate, narrowed somewhat ke at the lower, and truncate; the ventral suture is broader and than the dorsal.

fruit is dried partly by solar and partly by fire heat,—that is to s exposed alternately to the heat of an oven and to the open air. repared, it is about $1\frac{1}{4}$ inches long, black and shrivelled, but

[1] Lour-Deslongchamps et Michel, *Duhamel, ou Traité des arbres et arbustes que l'on cultive en France*, v. (1812) 189, pl. 54. fig. 2, pl. 56. fig. 9.

recovers its original size and form by digestion in warm water. The dried pulp or sarcocarp is brown and tough, with an acidulous, saccharine, fruity taste.

Microscopic Structure—The skin of the prune is formed of small, densely packed cells, loaded with a dark solid substance; the pulp consists of larger shrunken cells, containing a brownish amorphous mass which is probably rich in sugar. This latter tissue is traversed by a few thin fibro-vascular bundles, and exhibits here and there crystals of oxalate of calcium. By perchloride of iron, the cell walls as well as the contents of the cells, acquire a dingy greenish hue.

Chemical Composition—We are not aware of any analysis having been made of the particular sort of plum under notice, nor that any attempt has been made to discover the source of the medicinal property it is reputed to possess. Some nearly allied varieties have been submitted to analysis in the laboratory of Fresenius, and shown to contain saccharine matters to the extent of 17 to 35 per cent., besides malic acid and albuminoid and pectic substances.[1]

Uses—The only pharmaceutical preparation of which the pulp of prunes is an ingredient, is *Confectio Sennæ*, the *Electuarium lenitivum* of the old pharmacopœias. The fruit stewed and sweetened, is often used as a domestic laxative.

Substitute—When French prunes are scarce, a very similar fruit known in Germany as *Zwetschen* or *Quetschen*, is imported as a substitute. It is the produce of a tree which most botanists regard as a form of *Prunus domestica* L., termed by De Candolle var. *Pruncauliana*. Dr. Koch[3] however, is decidedly of opinion that it is a distinct species, and as such he has revived for it Borkhausen's name of *Prunus œconomica*. The tree is widely cultivated in Germany for the sake of its fruit, which is used in the dried state as an article of food, but is not grown in England.

The dried fruit differs slightly from the ordinary prune in being rather larger and more elongated, and having a thicker skin; also in the stone being flatter, narrower, pointed at either end, with the ventral suture much more strongly curved than the dorsal. The fruits seem rather more prone to become covered with a saccharine efflorescence.

CORTEX PRUNI SEROTINÆ.

Cortex Pruni Virginianæ; Wild Black Cherry Bark.

Botanical Origin—*Prunus serotina* Ehrhart (*P. Virginiana* Mill. non Linn., *Cerasus serotina* DC.)—A shrub or tree, in favourable situations growing to a height of 60 feet, distributed over an immense extent of North America. It is found throughout Canada as far as 62° N. lat., and from Newfoundland and Hudson's Bay in the east, to the valleys west of the Rocky Mountains.[4] It is also common in the United States.

[1] Liebig's *Ann. der Chemie*, ci. (1857) 228.

[2] This was especially the case in the winter of 1873–74.

[3] *Dendrologie*, part i. (1869) 94.

[4] Hooker, *Flora Boreali-Americana*, i. (1833) 169.

ee is often confounded with *P. Virginiana* L., from which, seems to be separated by no fixed character, though American hold the two plants as distinct. It is also nearly allied to the m *P. Padus.* L. of Europe, the bark of which had formerly a the Materia Medica.[1]

ry—Experiments on the medicinal value of Wild Cherry Bark e in America about the end of the last century, at which time was supposed to be useful in intermittent fevers.[2] The bark duced into the *United States Pharmacopœia* in 1820. An article by Bentley[3] published in 1863 contributed to bring it e in this country, but it is still much more employed in han with us.

iption—The inner bark of the root or branches is said to be suitable for medicinal use. That which we have seen, is from the latter; it is in flattish or channelled pieces, $\frac{1}{10}$ to $\frac{1}{20}$ h in thickness, $\frac{1}{2}$ an inch to 2 inches broad, and seldom ex- inches in length. From many of the pieces, the outer suberous een shaved off, in which case the whole bark is of a deep brown; in others the corky layer remains, exhibiting a atiny surface, marked with long transverse scars. The inner finely striated, or minutely fissured and reticulated. The ks easily with a short granular fracture; it is nearly without if reduced to coarse powder and wetted with water it evolves t odour of bitter almonds. It has a decided but transient e.

rk freshly cut from the stem is quite white, and has a strong bitter almonds and hydrocyanic acid.

scopic Structure—The chief mass of the tissue is made up of k-walled, white cells, the groups of which are separated by a rous prosenchyme. The liber is crossed in a radial direction ous broad medullary rays of the usual structure. The paren- s portion is loaded both with very large single crystals, and tufts of calcium oxalate. There is also an abundance of rch granules, and brown particles of tannic matters. Thin the bark moistened with perchloride of iron, assume a blackish

ical Composition—The bitterness and odour of the fresh nd in part, according to Procter,[4] on the presence of *Amyg-* Hydrocyanic acid and essential oil are produced when the stilled with water, and must be due to the mutual action of n and some principle of the nature of emulsin. From the fact xtract of the bark remained bitter although the whole of the n had been removed, Procter inferred the existence of another to which the tonic properties of the bark are perhaps due. dalin, however, has not been isolated.

resh bark was found by Perot[5] to yield $\frac{1}{2}$ per mille of hydro- id in April, 1 per mille in June, and 1·4 in October. The for collecting the bark is therefore the autumn.

, *Encyklopädie*, i. (1843) 500; *eygewächse*, iv. (1816) 40. *Collections for Mat. Med. of* , Philad. 1793. 11.

[3] *Pharm. Journ.* v. (1864) 97.
[4] *Am. Journ. of Pharm.* iv. (1839) 197.
[5] Ibid. xviii. (1852) 109.

Uses—In America, wild cherry bark is held in high estimation for its mildly tonic and sedative properties. It is administered most appropriately in the form of cold infusion or syrup, the latter being a strong cold infusion, sweetened; a fluid extract and a dry resinoid extract are also in use. The bark is said to deteriorate by keeping, and should be preferred when recently dried.

FOLIA LAURO-CERASI.

Common Laurel or Cherry-laurel Leaves; F. *Feuilles de Laurier-cerise;* G. *Kirschlorbeerblätter.*

Botanical Origin—*Prunus Lauro-cerasus* L., a handsome evergreen shrub, growing to the height of 18 or more feet, is a native of the Caucasian provinces of Russia (Mingrelia, Imeritia, Guriel), of the valleys of North-western Asia Minor, and Northern Persia. It has been introduced as a plant of ornament into all the more temperate regions of Europe, and flourishes well in England and other parts, where the winter is not severe and the summer not excessively hot and dry.

History—Pierre Belon, the French naturalist, who travelled in the East between 1546 and 1550, is stated by Clusius[1] to have discovered the cherry-laurel in the neighbourhood of Trebizond. Thirty years later Clusius himself obtained the plant through the Imperial ambassador at Constantinople, and distributed it from Vienna to the gardens of Germany. Since it is mentioned by Gerarde[2] as a choice garden shrub, it must have been cultivated in England prior to 1597. Ray,[3] who like Gerarde calls the plant *Cherry-bay*, states that it is not known to possess medicinal properties.

In 1731, Madden of Dublin drew the attention of the Royal Society of London[4] to some cases of poisoning that had occurred by the use of the distilled water of the leaves. This water he states had been for many years in frequent use in Ireland among cooks, for flavouring puddings and creams, and also much in vogue with dram drinkers as an addition to brandy, without any ill effects from it having been noticed. The fatal cases thus brought forward occasioned much investigation, but the true nature of the poison was not understood till pointed out by Schrader in 1803. Cherry-laurel water, though long used on the Continent, has never been much prescribed in Great Britain, and had no place in any British Pharmacopœia till 1839.

Description—The leaves are alternate, simple, of leathery texture and shining upper surface, 5 to 6 inches long by 1¾ to 2 inches wide, oblong or slightly obovate, attenuated towards either end. The thick leafstalk, scarcely half an inch in length, is prolonged as a stout midrib to the recurved apex. The margin, which is also recurved, is provided with sharp but very short serratures, which become more distant towards the base. The under side, which is of a paler colour and dull surface, is marked by 8 or 10 lateral veins, anastomosing towards the edge. Below the lower of these and close to the midrib, are from two to four shallow

[1] *Rariorum Plantarum Historia*, 1601. 4.
[2] *Herball* (1636), 1603.
[3] *Hist. Plant.* ii. (1693) 1549.
[4] *Phil. Trans.* xxxvii. (for 1731-32) 84.

pressions or *glands*, which in spring exude a saccharine matter, and on assume a brownish colour.

The fresh leaves are inodorous until they are bruised or torn, when ey instantly emit the smell of bitter almond oil and hydrocyanic acid. hen chewed they taste rough, aromatic and bitter.

Microscopic Structure—The upper surface of the leaf is constituted f thin cuticle and the epidermis made up of large, nearly cubic cells. he middle layer of the interior tissue exhibits densely packed small ells, whereas the prevailing part of the whole tissue is formed of larger, ose cells. Most of them are loaded with chlorophyll; some enclose rystals of oxalate of calcium.

Chemical Composition—The leaves when cut to pieces and subitted to distillation with water, yield *Bitter Almond Oil* and *Hydroanic Acid*, produced it is supposed by the decomposition of *Amygdalin* p. 220), which however has not been obtained from them. Moreover, e body which induces the decomposition is not known.

The proportion of hydrocyanic acid in the water has been the subt of many researches. Among the later are those of Broeker (1867), o distilled a given weight of the leaves grown in Holland under cisely similar circumstances, in each month of the year. The results oved that the product obtained during the winter and early spring, was aker in the acid in the proportion of 17 to 24, 28, or 30, the strongest ter being that distilled in July and August. This chemist found that stronger product was got when the leaves were chopped fine, than when ey were used whole. According to Christison,[1] the buds and very ung leaves yield ten times as much essential oil as the leaves one r old.

The fresh unwounded leaves of the cherry-laurel in vigorous vegetan, have been recently found by Schaer, whose experiments were made the request of one of us (F.), not to evolve naturally a trace of hydroanic acid, though they yield it on the slightest puncture. We are pletely ignorant of the mode of distribution in the living tissue of amygdalin and of the substance causing its decomposition, and how se two bodies are packed so as to prevent the slightest mutual reaction. e leaves may be even dried and powdered without the evolution of y odour of hydrocyanic acid, but the latter is at once developed by the ition of a little water.

Besides the substance concerned in the production of the essential l, the leaves contain sugar which reduces cupric oxide in the cold, a all quantity of an iron-greening tannin, and a fatty or waxy substance.

Schoonbroodt (1868) treated the aqueous extract of the fresh leaves h alcoholic ether, which yielded ¼ per mille of bitter, acicular crystals; se quickly reduced cupric oxide, losing their bitterness.

Uses—The leaves are only employed for making cherry-laurel water qua *Lauro-cerasi*), the use of which in England is generally superseded that of the more definite hydrocyanic acid.

[1] *Dispensatory*, 1842. 592.

FLORES KOSO.

Flores Brayeræ, Cusso, Kousso, Kosso.

Botanical Origin—*Hagenia Abyssinica* Lamarck (*Brayera anthelminthica* Kunth), a handsome tree growing to a height of 60 feet, found throughout the entire table-land of Abyssinia at an elevation of 3,000 to 8,000 feet above the sea-level. It is remarkable for its abundant foliage and fine panicles of flowers, and is generally planted about the Abyssinian villages.

History—The celebrated Bruce[1] during his journey to discover the source of the Nile, 1768–1773, found the koso tree in Abyssinia, observed the uses made of it by the natives, and published a figure of it in the narrative of his travels. It was also described in 1811 by Lamarck,[2] who called it *Hagenia* in honour of Dr. K. G. Hagen of Königsberg.

The anthelmintic virtues of koso were investigated by Brayer, a French physician of Constantinople, to which place parcels of the drug are occasionally brought by way of Egypt, and he published a small pamphlet on the subject.[3] Several scattered notices of koso appeared in 1839–40–41, but no supply of it reached Europe until about 1850, when a Frenchman who had been in Abyssinia, obtained a large stock (1,400 ℔., it was said), a portion of which he endeavoured to sell in London at 35*s. per ounce!* The absurd value set upon the drug produced the usual result: large quantities were imported, and the price gradually fell to 3*s.* or 4*s.* per ℔. Koso was admitted a place in the British Pharmacopœia of 1864.

Description—The flowers grow in broad panicles, 10 to 12 inches in length. They are unisexual, but though male and female occur on the same tree, the latter are chiefly collected. The panicles are either loosely dried, often including a portion of stalk and sometimes a leaf, or they are made into cylindrical rolls, kept in form by transverse ligatures. Very often the panicles arrive quite broken up, and with the flowers in a very fragmentary state. They have a herby, somewhat tea-like smell and a bitterish acrid taste.

The panicle consists of a zigzag stalk, which with its many branches is clothed with shaggy simple hairs, and also dotted over with minute stalked glands; it is provided at each ramification with a large sheathing bract. At the base of each flower are two or three rounded veiny membranous bracts, between which is the turbinate hairy calyx, having ten sepals arranged in a double series. In the male, the outer series consists of much smaller sepals than the inner; in the female, the outer in the ultimate developement become enlarged, obovate and spreading, so that the whole flower measures fully ½ an inch across. In both, the sepals are veiny and leaflike. The petals are minute and linear, inserted with the stamens in the throat of the calyx. These latter are 10 to 25 in number, with anthers in the female flower, effete. The carpels are two

[1] *Travels*, v. (1790) 73.

[2] *Encyclopédie Méthodique*, Bot., suppl. tome 2 (1811) 422.

[3] *Notice sur une nouvelle plante de la famille des Rosacées, employée contre le Tænia*, Paris, 1822. The reader should also consult the excellent notice by Pereira written when the drug was first offered for sale in London, *Pharm. Journ.* x. (1851) 15; reprinted in Pereira's *Elem. of Mat. Med.* ii. part 2 (1853) 1815.

d in the calycinal tube; and each surmounted by a hairy style. it is an obovate one-seeded nut.

o as seen in commerce has a light brown hue, with a reddish the case of the female flowers, so that panicles of the latter are nes distinguished as *Red Koso.*

emical Composition—Wittstein (1840) found in koso, together e substances common to most vegetables (wax, sugar and gum), cent. of tannin, and 6·25 of an acrid bitter resin, which was d by Harms (1857) to possess acid properties.

researches of Pavesi (1858), and still more those of Bedall of ,[1] have made us acquainted with the active principle of the drug, has been named *Koussin* or *Kosin.* It may be obtained by mixing vers with lime, exhausting them with alcohol and then with water; utions mixed, concentrated, and treated with acetic acid, deposit in. We are indebted to Dr. Bedall for a specimen of it, which we consist chiefly of an amorphous, resinoid substance, from which a few yellow crystals by means of glacial acetic acid.

Merck has lately favoured us with kosin prepared in his laboratory mstadt. It is a tasteless substance of a yellow colour, forming stals of the rhombic system,—readily soluble in benzol, bisulphide n, chloroform or ether, less freely in glacial acetic acid, and in- in water. Of alcohol, sp. gr. 0·818, 1000 parts dissolve at 12° C., 3 parts of this kosin. It is abundantly soluble in alkalies, caustic onated, yet has nevertheless no acid reaction, and may be preci- from these solutions by an acid, without having undergone any n. It is then however a white amorphous mass, which yields inal yellow crystals by re-solution in boiling alcohol, in which it s readily.

in fuses at 142° C., and remains after cooling an amorphous, rent, yellow mass; but if touched with the *smallest drop* of alcohol, diately assumes the form of stellate tufts of crystals. This striking enon may be repeated at pleasure, kosin not being altered by s fusion.

in is not decomposed by boiling dilute acids. It dissolves in ulphuric acid, giving a yellow solution which becomes turbid by ition of water, white amorphous kosin being thrown down. At e time a well-marked odour exactly like that of Locust Beans, due y to valerianic acid and amylic alcohol, is evolved; the same s emitted by kosin under many other circumstances. If the ic solution is allowed to stand for a week, it gradually assumes a ; and then yields on addition of much water, an amorphous red hich after drying is not soluble in bisulphide of carbon, and may purified. We have not yet succeeded in obtaining this red deri- f kosin in a crystalline state. The analysis which we have per- of kosin, assigns it the formula $C^{31}H^{38}O^{10}$. From experiments 874) being made at Giessen, it would appear that pure kosin is of action on the animal economy; yet, in the opinion of Prof. im, it acquires medicinal activity when combined with some rinciples existing in the drug.

illation with water separates from the flowers a stearoptene-like

[1] Wittstein's *Vierteljahrsschr. für prakt. Pharm.* viii. (1859) 481; xi. (1862) 207.

oil having the odour of koso, and traces of valerianic and acetic acid. No such body as the *Hagenic Acid* of Viale and Latini (1852), could be detected by Bedall.

Commerce—Koso is brought to England by way of Aden or Bombay; some appears also to reach Leghorn, probably carried thither direct from Egypt.

Uses—The drug is employed solely as a vermifuge, and is effectual for the expulsion both of *Tænia solium* and of *Bothriocephalus latus*. The Abyssinian practice is to administer the flowers in substance in a very ample dose, which is sometimes attended with alarming and even fatal results.

The notion that the action of the drug is partially mechanical and due to the hairs of the plant, prevails in England, and has led to the use of an *unstrained* infusion of the coarsely powdered flowers. This remedy from the quantity of branny powder (2 to 4 drachms) that has to be swallowed, is far from agreeable; and as it occasions strong purgation and sometimes vomiting, it is not often prescribed.[1]

PETALA ROSÆ GALLICÆ.

Flores Rosæ rubræ; Red Rose Petals, Rose Leaves, True Provins Roses; F. *Pétales de Roses rouges, Roses de Provins;* G. *Essigrosenblätter.*

Botanical Origin—*Rosa Gallica* L., a low-growing bush, with a creeping rhizome throwing up numerous stems. The wild form with single flowers, occurs here and there in the warmer parts of Europe,[2] including Central and Southern Russia, and Greece; also in Asia Minor, Armenia, and the Caucasus. But the plant passes into so many varieties, and has from a remote period been so widely cultivated, that its distribution cannot be ascertained with any exactness. As a garden plant it exists under a multitude of forms.

History—The use in medicine of the rose dates from a very remote period. Theophrastus[3] who flourished in the 4th and 3rd centuries B.C., speaks of roses being of many kinds, including some with double flowers which were the most fragrant; and he also alludes to their use in the healing art. Succeeding writers of every age down to a recent period have discussed the virtues of the rose,[4] which however is scarcely now admitted to possess any special medicinal property.

One of the varieties of *R. Gallica* is the *Provins Rose*, so called from having been long cultivated at Provins,[5] a small town about 60 miles south-east of Paris, where it is said to have been introduced from the East by Thibaud VI. Count of Champagne, who died on his return from

[1] Johnston in his *Travels in Southern Abyssinia* (1844), speaking of koso, says its effects are "*dreadfully severe.*"—Even in Abyssinia, he adds, it is barely tolerated, and if any other remedy equally efficient for dislodging tapeworm were to be introduced, koso would be soon abandoned.

[2] It has lately been found in a *quasi*-wild state at Charlwood in Surrey.—*Seemann's Journ. of Bot.* ix. (1871) 273.

[3] *Hist. Plant.* lib. vi. c. 6.

[4] Consult in particular the learned essay of D'Orbessan contained in his *Mélanges historiques*, ii. (1768) 297–337.

[5] Koch (*Dendrologie*, i. 1869. 250) asserts that the rose originally cultivated at Provins was a *Damask Rose*, but that in the second half of the 18th century its place was taken by a variety of *R. Gallica*. This seems very improbable: Pomet (1692) speaks of the roses of Provins being "hautes en couleur, c'est à dire d'un rouge noir, velouté . . . & très astringentes,"—characters specially belonging to *R. Gallica*.

ıades, A.D. 1254. Be this as it may, Provins became much ed not only for its dried rose-petals, but also for the conserve, ıd honey of roses made from them,—compositions which were l in the light of valuable medicines.[1]

recorded that when in A.D. 1310, Philippe de Marigny, arch- ıf Sens, made a solemn entry into Provins, he was presented by ıbles of the town with wine, spices, and *Conserve of Roses;* and ı of dried roses and of the conserve were not considered beneath ce of Catherine de Medicis, and of Henry IV.[2]

find that Charles Estienne, in 1536, mentions both the *Rosæ æ odoratissimæ*, which he says are called *Provinciales*, and those to the druggists as *incarnatæ*,—the latter we presume a *pale Rosæ rubeæ* are named as an ingredient of various compound es by Valerius Cordus.[4]

luction—The flowers are gathered while in bud and just xpansion, and the petals are cut off near the base, leaving the ıws attached to the calyx. They are then carefully and rapidly · the heat of a stove, and having been gently sifted to remove ıments, are ready for sale. In some districts the petals are dried ıut the drug thus produced is not so nice.

England, the Red Rose is cultivated at Mitcham, though now the extent of about 10 acres. It is also grown for druggists' use rdshire and Derbyshire. At Mitcham, it is now called *Damask* ich is by no means a correct name. The English dried roses ıd a high price.

e is a much more extensive cultivation of this rose on the ıt at Wassenaar and Noordwijk in Holland; in the vicinity of g and Nuremberg in Germany, and in the villages round Paris ons. Roses are still, we believe, grown for medicinal use at , but are no longer held in great esteem.

e appears to be a considerable production of dried roses in udging from the fact that in the year 1871–72, 1163 cwt. were l from the Persian Gulf to Bombay.[5]

cription—The petals adhere together loosely in the form of nes, or are more or less crumpled and separate. When well d, they are crisp and dry, with a velvety surface of an intense crimson, a delicious rosy odour, and a mildly astringent taste. ite basal portion of the petals should be nearly absent. For the confection, the petals are required in a fresh state.

mical Composition—Red rose petals impart to ether, without ıeir colour, a soft yellow substance, which is a mixture of a solid *Quercitrin*. Filhol has shown (1864) that it is the latter body, tannic acid, of which the petals contain but a trace, that pro- e dark greenish precipitate with ferric salts. The same chemist ı the petals 20 per cent. (?) of glucose which, together with

Hist. des Drogues, 1694, part i.

Légendes, curiosités et traditions pagne et de la Brie, Paris, 1860.

[3] Stephanus (Carolus), *De re hortensi libellus*, Paris, 1536, 29. (in Brit. Mus.)

[4] *Dispensatorium*, 1548. 39. 52.

[5] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1871–72, pt. ii. 43.

colouring matter and gallic acid, is extracted by alcohol after exhaustion by ether. According to Rochleder (1867), the gallic acid in red roses is accompanied by quercitannic acid.

The colouring matter which is so striking a constituent of the petals, has not yet been isolated and studied in a satisfactory manner.[1] An infusion of the petals is pale red, but becomes immediately of a deep and brilliant crimson if we add to it an acid, such as sulphuric, hydrochloric, acetic, oxalic, or tartaric. An alkali changes the pale red, or the deep crimson in the case of the acidulated infusion, to bright green.

Uses—An infusion of red rose petals, acidulated with sulphuric acid and slightly sweetened, is a very common and agreeable vehicle for some other medicines. The confection made by beating up the petals with sugar, is also in use.

PETALA ROSÆ CENTIFOLIÆ.

Flores rosæ pallidæ v. incarnatæ; Provence Rose, Cabbage Rose; F. *Pétales de Roses pâles;* G. *Centifolienrosen.*

Botanical Origin—*Rosa centifolia* L.—This rose grows in a wild state and with single flowers in the eastern part of the Caucasus.[2] Cultivated and with flowers more or less double, it is found under an infinity of varieties in all the temperate regions of the globe. The particular variety which is grown in England for medicinal use, is known in English gardens as the *Cabbage Rose*, but other varieties are cultivated for similar purposes on the Continent.

R. centifolia L. is very closely allied to *R. Gallica* L.; though Boissier maintains the two species, there are other botanists who regard them as but one. The rose cultivated at Puteaux near Paris for druggists' use, and hence called *Rose de Puteaux*, is the *Rosæ bifera* of Redouté, placed by De Candolle though doubtfully under *R. Damascena*.

History—We are unable to trace the history of the particular variety of rose under notice. That it is not of recent origin, seems evident from its occurrence chiefly in old gardens. The *Rosa pallida* of the older English writers on drugs[3] was called *Damask Rose*, but that name is now applied at Mitcham to *Rosa Gallica* L., which has very deep-coloured flowers.

Production—The Cabbage Rose is cultivated in England to a very small extent, rose water which is made from its flowers, being procurable of better quality and at a lower cost in other countries, especially in the south of France. At Mitcham, whence the London druggists have long been supplied, there are now (1873) only about 8 acres planted with this rose, but a supply is also derived from the market gardens of Putney, Hammersmith and Fulham.

Description—The Cabbage Rose is supplied to the druggists in the fresh state, full blown, and picked off close below the calyx. A complete description is scarcely required: we need only say that it is a large and very double rose, of a beautiful pink colour and of delicious odour. The calyx is covered with short setæ tipped with a fragrant, brown, viscid

[1] See however a paper by Filhol in *Journ. de Pharm.* xxxviii. (1860) 21; also Gmelin, *Chemistry*, xvi. (1864) 522.

[2] Boissier, *Flora Orientalis*, ii. (1872) 678.

[3] As Dale, *Pharmacologia*, 1693. 416.

retion. The petals are thin and delicate (not thick and leathery as in Tea Roses), and turn brown on drying.

In making rose water, it is the custom in some laboratories to strip the tals from the calyx and to reject the latter; in others, the roses are tilled entire, and so far as we have observed, with equally good result.

Chemical Composition—In a chemical point of view, the petals of *centifolia* agree with those of *R. Gallica*, even as to the colouring tter. Enz in 1867 obtained from the former, malic and tartaric acid, nin, fat, resin, and sugar.

In the distillation of large quantities of the flowers, a little essential oil btained. It is a butyraceous substance, of weak rose-like, but not very eeable odour. It contains a large proportion of inodorous stearoptene. r further particulars see remarks under the head *Attar of Rose*, p. 235.

Uses—Cabbage roses are now scarcely employed in pharmacy for r other purpose than making rose water. A syrup used to be prepared m them, which was esteemed a mild laxative.

OLEUM ROSÆ.

Attar or Otto[1] *of Rose, Rose Oil;* F. *Essence de Roses;* G. *Rosenöl.*

Botanical Origin—*Rosa Damascena* Miller, var.—This is the rose ltivated in Turkey for the production of attar of rose; it is a tall ub with semi-double, light-red (rarely white) flowers, of moderate e, produced several on a branch, though not in clusters. Living cimens sent by Baur[2] which flowered at Tübingen, were examined by von Mohl and named as above.[3]

R. Damascena is unknown in a wild state. Koch[4] asserts that it was ught in remote times to Southern Italy, whence it spread northward.

History—Much as roses were prized by the ancients, no preparation ch as rose water or attar of rose was obtained from them. The liquid t bore the name of *Rose Oil* (ῥόδινον ἔλαιον), is stated by Dioscorides[5] be a fatty oil in which roses have been steeped. In Europe a similar eparation was in use down to the last century, *Oleum rosarum, rosatum rosaceum*, signifying an infusion of roses in olive oil.[6]

The first allusion to the distillation of roses we have met with, is in e writings of Joannes Actuarius,[7] who was physician to the Greek perors at Constantinople towards the close of the 13th century. Rose ter was distilled at an early date in Persia; and Nisibin, a town th-west of Mosul, was famous for it in the 14th century.[8]

Kämpfer speaks[9] with admiration of the roses he saw at Shiraz 1683–4), and says that the water distilled from them is exported to ther parts of Persia, as well as to all India; and he adds as a singular ct, that there separates from it, a certain fat like butter, called *Ettr*

[1] *Attar* or *Otto* is from the word *itr* sig- ying *perfume* or *odour;* the oil is called Turkish *Itr-yàghi* i.e. *Perfume-oil*, and *Ghyùl-yàghi* i.e. *Rose-oil.*

[2] A living plant followed by excellent barium specimens has been kindly given me by Dr. Baur of Blaubeuren, the father Prof. Dr. Baur of Constantinople, but it not yet flowered (29 July 1873).—D. H.

[3] Wiggers u. Husemann, *Jahresbericht* for 1867. 350.

[4] *Dendrologie*, i. (1869) 250.

[5] Lib. i. c. 53.

[6] As in the *London Pharmacopœia* of 1721.

[7] ". . . . stillatitii rosarum liquoris libra una."—*De Methodo Medendi*, lib. v. c. 4.

[8] *Voyage d'Ibn Batoutah*, trad. par Defrémery, ii. (1854) 140.

[9] *Amœnitates*, 1712. 373.

gyl of the most exquisite odour, and more valuable even than gold. commerce to India, though much declining, still exists; and in the 1872–73, 20,100 gallons of rose water, valued at 35,178 rupees (£3, were imported into Bombay from the Persian Gulf.[1]

Rose water was much used in Europe during the middle ages, b cookery and at table. In some parts of France, vassals were com to furnish to their lords so many bushels of roses, which were cons in the distillation of rose water.[2]

The fact that a butyraceous oil of delicious fragrance is sep from rose water, was noticed by Geronimo Rossi[3] of Ravenna in and by Giovanni Battista Porta[4] of Naples in 1589: the latter i work on distillation says—"Omnium difficillimæ extractionis est rum oleum atque in minima quantitate sed suavissimi odoris."[5] oil was also known to the apothecaries of Germany of the 17th ce and is quoted in official drug-tariffs as early as 1614.[6] In Pomet's (1694) it was sold in Paris, though, on account of its high price, o very small quantity. The mention of it by Homberg[7] in 1700, a a memoir by Aublet[8] (1775) respecting the distillation of roses i Isle of France, shows that the French perfumers of the last ce were not unacquainted with true rose oil, but that it was a rare and costly article.

The history of the discovery of the essence in India, is the subj an interesting and learned pamphlet by Langlès,[9] published in 1804 tells on the authority of oriental writers, how on the occasion o marriage of the Mogul emperor Jehan Ghir with Nur-jehan, A.D. a canal in the garden of the palace was filled with rose water, and the princess observing a certain scum on the surface, caused it to b lected and found it of admirable fragrance, on which account it re the name of *Atar-jehanghiri*, i.e. *perfume of Jehan Ghir*. In later t Polier[10] has shown that rose oil is prepared in India by simple d lation of the flowers with water. But this Indian oil has never imported into Europe as an article of trade.

As already stated, the supplies at present come from Eur Turkey; but at what period the cultivation of the rose and manuf of its oil were there introduced, is a question on which we are qui the dark. There is no mention of attar in the account given by Sav in 1750 of the trade of Constantinople and Smyrna.

In English commerce, attar of rose was scarcely known unti commencement of the present century. It was first included i British Tariff in 1809, when the duty levied on it was 10*s.* per o In 1813, the duty was raised to 11*s.* 10½*d.*; in 1819 it was 6*s.*, a 1828, 2*s.* per ounce. In 1832 it was lowered to 1*s.* 4*d.* per ℔., in to 1*s.*, and in 1860 it was altogether removed.[12]

[1] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1872–73, part ii. 52.

[2] Le Grand d'Aussy, *Hist. de la vie privée des François*, ii. (1815) 250.

[3] Hieronymi Rubei Rav. *De Destillatione*, Ravennæ, 1582. 102.

[4] *Magiæ Naturalis libri xx.*, Neap. 1589. 188.

[5] *De Distillatione*, Rom. (1608) 75.

[6] As that printed at Giessen, referred to at p. 77, note 5.

[7] *Observations sur les huiles des pl Mém. de l'Acad. Roy. des Sciences*, 170

[8] *Hist. des Plantes de la Guiane fr* ii., Mémoires, p. 125.

[9] *Recherches sur la découverte de l'. de Rose*, Paris, 1804.

[10] *Asiatick Researches*, i. (1788) 33

[11] *Dict. de Commerce*, iv. 548.

[12] Information obligingly commu by Mr. Seldon of the Statistical Offic Custom House.

arching a file of the *London Price Current*, the first mention of *Rose*" is in 1813, from which year it is regularly quoted. The bond) from 1813 to 1815, varied from £3 to £5 5*s.* per ounce. iest notice of an importation is under date 1–8 July, 1813, y was paid on 232 ounces, shipped from Smyrna.

uction—The chief locality for attar of rose, and that by which commerce is almost exclusively supplied, is a small tract of n the southern side of the Balkan mountains in the Turkish of Rumelia. The principal seat of the trade is the town of in the fine valley of the Tunja. The other important districts of Philippopoli, Eski Zaghra, Yeni Zaghra and Tchirpan, which anlik were estimated in 1859 to include 140 villages, having ls.

ose is cultivated by Bulgarian and Turkish peasants in gardens fields, in which it is planted in rows as hedges, 3 to 4 feet high. localities are those occupying southern or south-eastern slopes. ns in high mountainous situations generally yield less, and the quality that easily congeals. The flowers attain perfection in l May, and are gathered before sunrise; those not wanted for e use are spread out in cellars, but are always used for distilling day. The apparatus is a copper still of the simplest descrip- nected with a straight tin tube, cooled by being passed through by a stream of water. The charge for a still is 25 to 50 ℔. of m which the calyces are not removed. The first runnings are to the still; the second portion which is received in glass kept at a temperature not lower than 15° C. (60° F.) for a day or which time most of the oil, bright and fluid, will have risen rface. From this, it is skimmed off by means of a small tin aving a fine orifice, and provided with a long handle. There are everal stills together.

produce is extremely variable. According to Baur,[1] whose in- account of attar of rose is that of an eye-witness, it may be verage 0·04 per cent. Another authority estimates the average)·037 per cent.

harvest during the five years 1867–71 was reckoned to average t below 400,000 *meticals*,[2] or 4,226 ℔. avoirdupois; that of ich was good, was estimated at 500,000 *meticals*, value about

are cultivated to a considerable extent about Grasse, Cannes in the south of France; and besides much rose water, which exported to England, a little oil is produced. The latter, mmands a high price, fuses less easily than the Turkish.

is a large cultivation of the rose for the purpose of making rose d attar, at Ghazipur on the Ganges, Lahore, Amritsar and other India, but the produce is wholly consumed in the country. ies thus cultivated is stated by Brandis[4] to be *R. Damascena*. Fayum, south-west of Cairo, supplies the great demand of r rose vinegar and rose water.

Jahrbuch f. Pharm. xxvii. (1867); *rm.* ix. (1868) 286.

ar Reports presented to Parlia-, 1872.—The *metical*, *miskal* or qual to about 3 dwt. troy.

[3] *Consular Reports presented to Parliament*, Aug. 1873. 1090.

[4] *Forest Flora of North-western and Central India*, 1874. 200.

Tunis has also some celebrity for similar products, which however do not reach Europe. A recent traveller[1] states that the rose grown there, and from which attar is obtained, is *Rosa canina* L., which is extremely fragrant; 30 ℔. of the flowers afford about 1½ drachm, worth 15*s*.

The butyraceous oil which may be collected in distilling roses in England for rose water is of no value as a perfume.

Description—Oil of rose is a light-yellow liquid, of sp. gr. 0·87 to 0·89. By a reduction of temperature, it concretes owing to the separation of light, brilliant, platy crystals of a stearoptene, the proportion of which differs with the country in which the roses have been grown, the state of the weather during which the flowers were gathered, and other circumstances less well ascertained. The oil produced in Turkey solidifies, according to Baur, at from 11 to 16° C. In some experiments made by one of us[2] in 1859, the *fusing* point of true Turkish attar was found to vary from 16 to 18° C.; that of a sample from India was 20° C.; of oil distilled in the south of France, 21 to 23° C.; of an oil produced in Paris, 29° C.; of oil obtained in distilling roses for rose water in London, 30 to 32° C.

From these data, it appears that a cool northern climate is not conducive to the production of a highly odorous oil; and even in Turkey, experience shows that the oil of the mountain districts, holds a larger proportion of stearoptene than that of the lowlands.

Turkish oil of rose is stated by Baur to deviate a ray of polarized light 4° to the right, when examined in a column of 100 mm. The oil from English roses which we examined, exhibited no rotation.

Chemical Composition—Rose oil is a mixture of a liquid constituent containing oxygen, to which it owes its perfume, and the solid hydrocarbon or stearoptene already mentioned, which is entirely destitute of odour. The proportion which these bodies bear to each other cannot be exactly determined, but is certainly extremely variable. From the Turkish oil, it may be obtained to the extent of 18 per cent., and from French and English to 35, 42, 60 or even 68 per cent.

Though the stearoptene can be entirely freed from the oxygenated oil, no method is known for the complete isolation of the latter. As obtained by Gladstone,[3] it had a sp. gr. of 0·881 and a boiling point of 216° C.

With regard to the stearoptene of rose oil, the analyses of Théodore de Saussure (1820) and Blanchet (1833), long since showed its composition to accord with the formula C^nH^{2n}. The experiments of one of us[4] confirm this striking fact, which assigns to the stearoptene in question a very exceptional place among the hydrocarbons of volatile oils, all of which are less rich in hydrogen.

Rose stearoptene separates when attar of rose is mixed with spirit of wine. We have isolated it also from oil obtained from Mitcham roses, by dissolving the oil in chloroform and precipitating with spirit of wine the process being several times repeated. The stearoptene was lastly

[1] Von Maltzan, *Reise in den Regentschaften Tunis und Tripolis*, Leipzig, 1870.

[2] Hanbury, *Pharm. Journ.* xviii. (1859) 504—509; Wittstein's *Vierteljahresschr. f. prakt. Pharm.* ix. (1860) 55.

[3] *Journ. of Chem. Soc.*, x. (1872) 12.

[4] Flückiger, *Pharm. Journ.* x. (1869) 147

ed for some days at 100° C.; thus obtained, it is inodorous, but ıted evolves an offensive smell like that of heated wax or fat. C. it melts; at 150° C. vapours are evolved; at 272° C. it begins ɔon after which it turns brown and then blackish. Stains of ɔptene on paper, do not disappear by the heat of the water-bath apse of some days.

ıtiously melted by the warmth of the sun, the stearoptene forms ıg microscopic crystals of very peculiar shape. Most of them form of truncated hexahedral pyramids, not however belonging ɔmbohedric system, as the angles are evidently not equal; many are oddly curved, thus §. Examined under the polarizing ɔe, these crystals from their refractive power make a brilliant

stearoptene is a very stable body, yet by boiling it for some ı fuming nitric acid, it is slowly dissolved, and converted into ıcids of the homologous series of fatty acids, and into oxalic rhaps likewise partly into fumaric acid. Among the former, ted butyric and valerianic. The chief product is however ıcid, which we obtained in pure crystals, showing all the well- actions.

ame products are obtained even much easier, by treating paraffin ic acid; it yields however less of succinic acid. The general r and appearance of paraffin is in fact nearly the same as that earoptene. But what is called *paraffin*, is by no means always the same body, but rather a series of extremely similar ɔons, the separation of which has not yet been thoroughly They may as well answer to the formula C^nH^{2n+2} as to that ıitherto, namely C^nH^{2n} (n being usually supposed equal to 20). consideration applying to rose stearoptene, the above-mentioned results can be regarded as in accordance with either of these

ıusion point of the different kinds of paraffin generally ranges to 60° C., yet one sort from the bituminous shale of Autun, and examined by Laurent,[1] melts at 33° C., and in this respect ith our stearoptene. It is therefore probable that the latter ɔelongs to the paraffin series.

merce—Formerly attar of rose came into commerce by way of it is now shipped from Constantinople. From the interior, it orted in flattened round tin bottles called *kunkumas*, holding ı 10 ℔., which are sewed up in white woollen cloth. These s reach this country, but more commonly the attar is transferred ıntinople to small white glass bottles, ornamented with gilding, from Germany.

—Attar of rose is of no medicinal importance, but serves lly as a scent for ointments. Rose water is sometimes made ɔut is not so good as that distilled from the flowers. Attar is ɜd in perfumery, but still more in the scenting of snuff.

teration—No drug is more subject than attar of rose to ion, which is principally effected by the addition of the volatile Indian grass, *Andropogon Schœnanthus* L. This oil, which is

[1] *Ann. de Chim. et de Phys.*, liv. (1833) 394.

called in Turkish *Idris yàghi*, and also *Entershah*, and is more or less known to Europeans as *Geranium Oil*, is imported into Turkey for this express purpose, and even submitted to a sort of purification before being used.[1] It was formerly added to the attar only in Constantinople, but now the mixing takes place at the seat of the manufacture. It is said that in many places, the roses are absolutely sprinkled with it before being placed in the still. As grass oil does not solidify by cold, its admixture with rose oil renders the latter less disposed to crystallize. Hence arises a preference among the dealers in Turkey for attar of the mountain districts, which, having a good proportion of stearoptene, will bear the larger dilution with grass oil without its tendency to crystallize becoming suspiciously small. Thus, in the circular of a commercial house of Constantinople, dated from Kizanlik, occur the phrases—"*Extra strong oil*,"—"*Good strong congealing oil*,"—"*Strong good freezing oil*";—while the 3rd quality of attar is spoken of as a "*not congealing oil*." The same circular states the belief of the writers, that in the season in which they wrote, "*not a single metical of unadulterated oil*" would be sent away.

The chief criteria, according to Baur, for the purity of rose oil are:—1. *Temperature at which crystallization takes place:* a good oil should congeal well in five minutes at a temperature of 12·5° C. (55° F.). 2. *Manner of crystallizing.*—The crystals should be light, feathery, shining plates, filling the whole liquid. Spermaceti, which has been sometimes used to replace the stearoptene, is liable to settle down in a *solid cake*, and is easily recognizable. Furthermore, it melts at 50° C. and so do most varieties of paraffin. The microscopic crystals of the latter are somewhat similar to those of rose stearoptene, yet they may be distinguished by an attentive comparative examination.

FRUCTUS ROSÆ CANINÆ.

Cynosbata; Fruit of the Dog-rose, Hips; F. *Fruits de Cynorrhodon;* G. *Hagebutten.*

Botanical Origin—*Rosa canina* L., a bush often 10 to 12 feet high, found in hedges and thickets throughout Europe except Lapland and Finland, and reaching the Canary Islands, Northern Africa, Persia and Siberia; universally dispersed throughout the British Islands.[2]

History—The fruits of the wild rose, including other species besides *R. canina* L., have a scanty, orange, acid, edible pulp, on account of which they were collected in ancient times when garden fruits were few and scarce. Galen[3] mentions them as gathered by country people in his day, as they still are in Europe. Gerarde in the 16th century remarks that the fruit when ripe—"maketh most pleasant meats and banqueting dishes, as tarts and such like." Though the pulp of hips preserved with sugar which is here alluded to, is no longer brought to

[1] For particulars, see Baur (p. 235, note 1).

[2] Baker, *Journ. of Linn. Soc.* Bot. xi. (1869) 226. In the Amur country a much larger and better fruit is afforded by *R. acicularis* Lindl. and *R. cinnamomea* L.—Maximowicz, *Primitiæ Floræ Amurensis*, 1859, 100. 451.

[3] *De Alimentorum facultatibus*, ii. c. 14.

, at least in th ntry,[1] it retains a place in pharmacy as a useful edient of pill-n es d electuaries.

Description—The fruit of a rose consists of the bottle-shaped calyx, me dilated and succulent by growth, and sometimes crowned with ify segments, enclosing numerous dry carpels or achenes, containing one exalbuminous seed. The fruit of *R. canina* called a *hip*, is ovoid, it ¾ of an inch long, with a smooth, red, shining surface. It is of a e, fleshy texture, becoming on maturity, especially after frost, soft pulpy, the pulp within the shining skin being of an orange colour, of an agreeable sweetish subacid taste. The large interior cavity ains numerous, hard achenes, which as well as the walls of the ier, are covered with strong short hairs.

For medicinal use, the only part required is the soft orange pulp, ch is separated by rubbing it through a hair sieve.

Microscopic Structure—The epidermis of the fruit is made up of lar cells containing red granules, which are much more abundant in pulp. The latter, as usual in many ripe fruits, consists of isolated no longer forming a coherent tissue. Besides these cells, there r small fibro-vascular bundles. Some of the cells enclose tufted tals of oxalate of calcium; most of them however are loaded with red ules, either globular or somewhat elongated. They assume a bluish on addition of perchloride of iron, and are turned blackish by iodine. latter coloration reminds one of that assumed by starch granules r similar circumstances; yet, on addition of a very dilute solution dine, the granules always exhibit a *blackish*, not a blue tint, so that are not to be considered as starch granules. The hairs of the pulp ormed of a single, thick-walled cell, straight or sometimes a little ced.

Chemical Composition—The pulp examined by Biltz (1824) was d to afford nearly 3 per cent. of citric acid, 7·7 of malic acid, les citrates, malates and mineral salts, 25 per cent. of gum, and 30 ncrystallizable sugar.

Uses—Hips are employed solely on account of their pulp, which d with twice its weight of sugar, constitutes the *Confectio Rosæ* ae of pharmacy.

SEMEN CYDONIÆ.

ence Seeds, Quince Pips; F. *Semences ou Pepins de Coings*; G. *Quittensamen*.

Botanical Origin—*Pirus Cydonia* L. (*Cydonia vulgaris* Pers.), the ce tree, is supposed to be a true native of Western Asia, from the asian provinces of Russia to the Hindu Kush range in Northern But it is now apparently wild also, in many of the countries h surround the Mediterranean basin.

n a cultivated state, it flourishes throughout temperate Europe, but more productive in southern than in northern regions. Quinces in the south of England, but not in Scotland.

[1] In Switzerland and Alsace a very agreeable *confiture* of hips is still in use.

History—The quince was held in high esteem by the ancients, who considered it an emblem of happiness and fertility; and as such, it was dedicated to Venus, whose temples it was used to decorate. Some antiquarians maintain that quinces were the *Golden Apples* of the Hesperides.

Porcius Cato in his graphic description of the management of a Roman farmhouse, alludes to the storing of quinces both cultivated and wild; and there is much other evidence to prove that from an early period the quince was abundantly grown throughout Italy. Charlemagne, A.D. 812, enjoined its cultivation in central Europe.[1] At what period it was introduced into Britain is not evident, but we have observed that *Baked Quinces* are mentioned among the viands served at the famous installation feast of Nevill, archbishop of York in 1466.[2]

The use of mucilage of quince seeds has come to us through the Arabians.

Description—The quince is a handsome fruit of a golden yellow, in shape and size resembling a pear. It has a very agreeable and powerful smell, but an austere, astringent taste, so that it is not eatable in the raw state. In structure, it differs from an apple or a pear in having many seeds in each cell, instead of only two.

The fruit is, like an apple, 5-celled, with each cell containing a double row of closely-packed seeds, 8 to 14 in number, cohering by a soft mucilaginous membrane with which each is surrounded. By drying they become hard, but remain agglutinated as in the cell. The seeds have an ovoid or obconic form, rather flattened and 3-sided by mutual pressure. From the hilum at the lower pointed end, the raphe passes as a straight ridge to the opposite extremity, which is slightly beaked and marked with a scar indicating the chalaza. The edge opposite the raphe is more or less arched, according to the position of the individual seed in the cell. The testa encloses two thick, veined cotyledons, having a straight radicle directed towards the hilum.

Quince seeds have a mahogany-brown colour, and when unbroken a simply mucilaginous taste. But the kernels have the odour and taste of bitter almonds, and evolve hydrocyanic acid when comminuted and mixed with water.

Microscopic Structure—The epidermis of the seed consists of one row of cylindrical cells, the walls of which swell up in the presence of water and are dissolved, so as to yield an abundance of mucilage. This process can easily be observed, if thin sections of the seed are examined under glycerin, which acts on them but slowly.

Chemical Composition—The mucilage of the epidermis is present in such quantity, that the seed easily coagulates forty times its weight of water. By complete exhaustion, the seeds afford about 20 per cent of dry mucilage, having the composition $C^{12}H^{20}O^{10}$, and therefore corresponding with that of linseed. The mucilage of quince seeds contains considerable quantities of calcium salts and albuminous matter, of which it is not easily deprived. When treated with nitric acid, it yields oxalic acid. After a short treatment with strong sulphuric acid it is coloured blue by iodine.

[1] Pertz, *Monumenta Germaniæ historica*, Legum, i. (1835) 187.

[2] Leland, *De rebus Britannicis Collectanea*, vi. (1774) 5.

ıce mucilage has but little adhesive power, and is not thickened
ɪ. That portion of it which is really in a state of solution and
ıay be separated by filtration, is precipitable by metallic salts or
ıol. The latter precipitate after it has been dried, is no longer
l by water either cold or warm. Quince mucilage is, on the
o be regarded as a soluble modification of cellulose.

ımerce—Quince seeds reach England from Hamburg; and are
ly quoted in Hamburg price-currents as *Russian;* they are also
from the South of France and from the Cape of Good Hope.
ɜ largely imported into India from the Persian Gulf, and by land
ghanistan.

s—A decoction of quince seeds is occasionally used as a de-
external application in skin complaints. It is also sometimes
ı eye-lotions. Quince seeds are in general use among the natives
ı as a demulcent tonic and restorative. They have been found
y Europeans in dysentery.

HAMAMELIDEÆ.

STYRAX LIQUIDA.

Balsamum Styracis; Liquid Storax; F. *Styrax liquide;*
G. *Flüssiger Storax.*

ınical Origin—*Liquidambar orientalis* Miller (*L. imberbe*
ı handsome, umbrageous tree resembling a plane, growing to
ht of 30 to 40 feet or more,[1] and forming forests in the extreme
ɜstern part of Asia Minor. In this region the tree occurs in the
of Sighala near Melasso, about Budrum (the ancient Halicar-
ınd Moughla, also near Giova and Ullà in the Gulf of Giova,
ly near Marmorizza and Isgengak opposite Rhodes. It also
the valley of the El-Asi (the ancient Orontes), as proved by a
ı in the Vienna herbarium, collected by Gödel, Austrian Consul
ndretta. In this locality it was seen by Kotschy in 1835, but
ı for a plane. The same traveller informed one of us that he
it to occur at Narkislik, a village near Alexandretta.
tree is not known to grow in Cyprus, Candia, Rhodes, Kos, or
n any of the Greek or Turkish islands of the Mediterranean.[2]

ory—Two substances of different origin have been known from
period under the name of *Styrax* or *Storax*, namely the resin
r *officinale* L. (p. 246), and that of *Liquidambar orientalis* Miller,
r commonly distinguished as *Liquid Storax.*
rding to Krinos of Athens, who has carefully investigated the
f the drug,[3] the earliest allusions to Liquid Storax occur in the

good figure of *L. orientalis*, see
ones Plantarum (3rd series, 1867)

e old trees existing at the convent
aiti on the north coast of Cyprus,
t of Neophiti near Papho, speci-
ich were distributed by Kotschy
mbar imberbe Ait., agree in all
points with the American *L. styraciflua* L., and not with the Asiatic plant. Kotschy has told me that they have *certainly been planted*, and that no other examples exist in the island.—D. H.

[3] Περὶ Στύρακος, διατριβὴ φαρμακογραφική, ἐν Ἀθήναις, 1862.

writings of Aëtius and of Paulus Ægineta,[1] who name both *Storax* and *Liquid Storax* (στύραξ ὑγρὸς). Of these Greek physicians, who lived respectively in the 6th and 7th centuries, the second also mentions the resin of *Ζυγία*, which is regarded by Krinos as synonymous with the latter substance.[2]

We find in fact the term *Sigia* frequently mentioned by Rhazes (10th century) as signifying Liquid Storax. This and other Arabian physicians were also familiar with the same substance under the name of *Milh* (*may'a*) and also knew how and whence it was obtained.[3]

A curious account of the collecting of Liquid Storax from the tree *Zygia* and from another tree called *Stourika*, is given in the travels through Asia Minor to Palestine of the Russian abbot of Tver in A.D. 1113-1115.[4]

The wide exportation and ancient use of Liquid Storax are very remarkable: even in the first century, as appears by the author of the Periplus of the Erythrean Sea, Storax, by which term there can be but little doubt *Liquid Storax* was intended, was exported by the Red Sea to India. Whether the *Storax* and *Storax Isaurica* offered to the Church of Rome under St. Silvester, A.D. 314–335, by the emperor Constantine,[5] was Liquid Storax or the more precious resin of *Styrax officinale* L., is a point we cannot determine. That the Chinese used the drug was a fact known to Garcia d'Orta (1535–63): Bretschneider[6] has recently shown from Chinese sources that together with olibanum and myrrh, it was imported by the Arabs into China during the Ming dynasty, A.D. 1368–1628. This trade is still carried on: the drug is conveyed by way of the Red Sea to Bombay, and thence shipped to China. Official returns show that the quantity thus exported from Bombay in the year 1856–57 was 13,328 ℔. In the time of Kämpfer (1690–92), Liquid Storax was one of the most profitable articles of shipment to Japan.[7]

Liquid Storax is known in the East, at least in the price-currents and trade statistics of Europeans, by the strange-sounding name of *Rosa Mallocs* (*Rosa Mallas, Rosum Alloes, Rosmal*), a designation for it in use in the time of Garcia d'Orta. Clusius[8] considered it to be Arabic, which however the scholars whom we have consulted do not allow. Others identify it with *Rasamala*, the Malay name for *Altingia excelsa*.

The botanical origin of Liquid Storax was long a perplexing question to pharmacologists. It was correctly determined by Krinos, but his information on the subject published in a Greek newspaper in 1841, and repeated by Kosté in 1855,[9] attracted no attention in Western Europe. The question was also investigated by one of the authors of the present work, whose observations together with a figure of *Liquidambar orientale* Miller, was published in 1857.[10]

[1] *Medicæ Artis Principes post Hippocratem et Galenum*, Par. 1567.—Aetii tetr. 4. serm. 4. c. 122; P. Ægineta, *De re med.* vii. 20.

[2] The foliage of the Liquidambar much resembles that of the common maple (*Acer campestre* L.); hence the two trees as well as the plane (*Platanus orientalis* L.) are confounded under one name,—*Ζυγὸς* or *Ζυγία*. So *Styrax officinale* L. from the resemblance of its leaves to those of *Pirus Cydonia* L., is known in Greece as Ἀγρία κυδωνήα, i.e. *wild quince*.

[3] *Ibn Baytar*, Sontheimer's transl. ii. 539.

[4] Noroff, *Pèlerinage en Terre Sainte de l'Igoumène russe Daniel*, St. Pétersb. 1864.

[5] Vignolius, *Liber Pontificalis*, Romæ, (1724) 94.—The ancient Isauria was in Cilicia, the country of *Styrax officinale* L.

[6] *On the knowledge possessed by the Chinese of the Arabs*, &c., Lond. 1871. 19.

[7] *Hist. of Japan*, ed. Scheuchzer. i. 353.

[8] *Exoticorum Libri*, 245.

[9] Ἐγχειρίδιον Φαρμακολογίας, ἐκδ. Κωστῆ, 1855. 356.

[10] Hanbury, *Pharm. Journ.* xvi. (1857) 417. 461; *Bonplandia*, 1 Mai 1857; *Journ. de Pharm.* xxxi. (1857) 198; also *Pharm. Journ.* iv. (1863) 436.

Method of Extraction—The extraction of Liquid Storax is carried . in the forests of the south-west of Asia Minor, chiefly by a tribe of ndering Turcomans called *Yuruks*. The process has been described . the authority of Maltass and McCraith of Smyrna, and of Campbell, itish Consul at Rhodes.[1] The outer bark is said to be first removed m the trunk of the tree and rejected; the inner is then scraped with a peculiar iron knife or scraper, and thrown into pits until a fficient quantity has been collected. It is then boiled with water in a ge copper, by which process the resin is separated, so that it can be immed off. The boiled bark is put into hair bags and squeezed under rude lever, hot water being added to assist in the separation of the in, or as it is termed *yagh*, i.e. *oil*. Maltass states that the bark is ssed in the first instance *per se*, and afterwards treated with hot water. either case the products obtained are the opaque, grey, semi-fluid in known as *Liquid Storax*, and the fragrant cakes of foliaceous brown rk, once common but now rare in European pharmacy, called *Cortex ymiamatis*.

We are indebted to M. Felix Sahut of Montpellier for a specimen of bark of *Liquidambar orientalis*, cut from the trunk of a fine tree on property at the neighbouring village of Lattes. The bark which is ered with a very thick corky layer and soaked in its own fragrant in, shows no tendency to exfoliate. The investigations of Unger[2] in prus are consequently to us inexplicable; he asserts that the bark les off, like that of the plane, by continued exfoliation, which is not case with that of M. Sahut's tree.

Description—Liquid Storax is a soft viscid resin, usually of the sistence of honey, heavier than water, opaque and greyish brown. always contains water, which by long standing rises to the surface. one sample that had been kept more than 20 years, the resin at the tom of the bottle formed a transparent layer of a pale golden brown. en liquid storax is heated, it becomes by the loss of water, dark wn and transparent, the solid impurities settling to the bottom. ead out in a very thin layer, it partially dries, but does not wholly its stickiness. When free from water (which reddens litmus) it olves in alcohol, spirit of wine, chloroform, ether, glacial acetic acid, lphide of carbon, and most of the essential oils, but not in the most tile part of petroleum ("petroleum ether"). It has a pleasant amic smell, especially after it has been long kept; when recent, it ontaminated with an odour of bitumen or naphthalin that is far from eable. Its taste is sharply pungent, burning and aromatic.

When the opaque resin is subjected to microscopic examination, ll brownish granules are observed in a viscid, colourless, transparent id, besides which large drops of a mobile watery liquid may be disuished. In polarized light, numerous minute crystalline fragments a few larger tabular crystals are obvious. But when thin layers of resin are left on the object-glass in a warm place, feathery or spicular als (styracin) shoot out on the edge of the clear liquid, while in the sharply-defined drops above mentioned, rectangular tables and prisms (cinnamic acid) make their appearance. On applying more ath after the water is evaporated, all the substances unite into a

anbury, l.c.

[2] Unger u. Kotschy, *Die Insel Cypern*. Wien, 1865, 410.

transparent, dark-brown, thick liquid, which exhibits no crystalline structure on cooling, or only after a very long time. Among the fragments of the bark occurring in the crude resin, liber fibres are frequently observable.

Chemical Composition—The most remarkable constituent of Liquid Storax is a hydrocarbon, C^8H^8, first prepared by Simon in 1839, which exists in the resin as a liquid, and also in a modified form as a solid. The former called *Styrol, Cinnamene,* or *Cinnamol,* has a sp. gr. of 0·924, and a boiling point of 146° C. It is a colourless, mobile liquid which may be obtained by distilling with water liquid storax, the odour and burning taste of which it possesses. When heated for a considerable time to 100° C., or for a shorter period to 200° C., it is converted without change of composition into the colourless, transparent solid, *Metastyrol,* which unlike styrol, is not soluble in alcohol or ether. It has a sp. gr. of 1·054, and may be cut with a knife. By prolonged heating, it can be converted into its original liquid form.

Styrol absorbs oxygen, forming an acid, the composition of which has not yet been determined.

If all the styrol obtainable by distillation with water is removed from liquid storax, the residue when submitted to dry distillation yields, as Berthelot has shown (1869), a further quantity. Styrol has also been artificially formed by the same chemist, who regards it (1867) as a condensed *Acetylene,* namely *Tetracetylene,* $4(C^2H^2)$. Artificial styrol is devoid of rotatory power, whereas that obtained from liquid storax deviates, according to Berthelot, a ray of polarized light. We have ascertained that a solution of storax-resin in acetone has no such effect.

Of the other constituents of liquid storax, *Cinnamic Acid* and *Styracin* belong to the radical C^9H^7O (cinnamyl). The first, $C^9H^8O^2$, is easily extracted from the drug by boiling it in water with carbonate of sodium and lime, by which is obtained cinnamate of sodium, easily decomposable by acids. The process yields from 6 to 12 per cent., according to Löwe as much as 23 per cent., of crystallized cinnamic acid. The acid dissolves abundantly in ether, alcohol, or hot water, slightly in cold water; it is inodorous but has an acrid taste. It fuses at 129° C. and at a dull red heat is resolved into carbonic acid and styrol, which latter is therefore related to it in the same manner as benzene to benzoic acid.

Styracin[1] or *Cinnamylic Cinnamate,* $\left.\begin{matrix}C^9H^7O\\C^9H^9\end{matrix}\right\}O$, discovered by Bonastre in 1827, can be removed by ether, benzol or alcohol, after the separation from the resin of the styrol and cinnamic acid; for it is insoluble in water, and volatile only in super-heated steam. It crystallizes in tufts of long rectangular prisms, which melt at 38° C., but it frequently does not solidify in a crystalline form, or only after a long time, or remains as an oily liquid. In its purest state it is inodorous and tasteless. By concentrated solution of potash, it is resolved into cinnamate, and *Styrone,* $C^9H^{10}O$, which latter is not present in Liquid Storax.

Laubenheimer[2] has shown, that probably *Benzylic Alcohol,* C^7H^8O, boiling at 206° C., likewise occurs in Liquid Storax. The cinnamic acid

[1] Gmelin, *Chemistry,* xiii. (1859) 286. [2] *Ann. d. Chem. und Pharm.* 164 (1872) 238.

ts dissolved, partly in the water, but to a larger extent in the styrol. rystallization and that of the styracin is promoted by exposure to air.

By the action of oxidizing agents, as nitric or chromic acids, or perle of lead, the styrol and cinnamyl compounds are easily reduced, onic acid and water being evolved; and at the same time benzoic , bitter almond oil, and hydrocyanic acid are produced. These comnds are in fact abundantly evolved when 6 parts of Liquid Storax gently warmed with 1 p. of caustic soda, and then mixed with 3 p. ermanganate of potassium dissolved in 20 p. of water.

We have examined several samples of Liquid Storax of average lity, and found by exposure of small quantities to the heat of the m bath, that it lost from 10 to 20 per cent. of water. The remainder ted with alcohol, yielded a residue amounting to 13 to 18 per cent., isting chiefly of fragments of bark and inorganic impurities. The entage of the drug soluble in alcohol, to which is due its therapeutic e, thus amounts to 56 to 72. This part, as may be inferred from foregoing statements, consists of styrol, metastyrol, cinnamic acid, acin and, doubtless for a large part, also of *resin*, the amount of ch has not yet been ascertained nor its properties investigated.

Commerce—The annual production of Liquid Storax was estimated Campbell in 1855 as about 490 cwt. for the districts of Giova and , and 300 cwt. for those of Marmorizza and Isgengak. The drug is rted in barrels to Constantinople, Smyrna, Syra and Alexandria. e is also packed with a certain proportion of water in goat-skins, sent either by boats or overland to Smyrna, where it is transferred rrels and shipped mostly to Trieste.

The chief consumption of Liquid Storax would appear to be in India China. In the fiscal year 1866–67, Bombay imported 319 cwt. from Red Sea. Liquid Storax is seldom seen in the London drug-sales.

Uses—Liquid Storax, which the *British Pharmacopœia* directs to rified by solution in spirit of wine, is an ingredient in a few oldoned preparations but is hardly ever prescribed on its own account. stated to be expectorant and stimulant, and useful in chronic chial affections. It has lately been recommended (1865) as an nal application for the cure of scabies, for which purpose it is mixed linseed oil.

Adulteration—The drug is occasionally mixed with sand, ashes and substances; these would be detected by solution in spirit of wine, ll as by the microscope.

Allied Substances.

Styrax Calamita (*Storax en pain* Guibourt)—The substance that pears this name is by no means the *Styrax Calamita* of ancient , but is an artificial compound made by mixing the residual Liquid- r bark called *Cortex Thymiamatis* (p. 243), coarsely powdered, Liquid Storax in the proportions of 3 to 2. It is at first a clammy acquiring after a few weeks an appearance of mouldiness, due to e silky crystals of styracin. It is usually imported in wooden , and has a very sweet smell. When the bark is scarce, common st is substituted for it, while qualities still inferior are made up

with the help of olibanum, honey, and earthy substances. This drug is manufactured at Trieste, Venice and Marseilles.

Several other odoriferous compounds of which Liquid Storax appears to be the chief ingredient, are made in the East and may still be found in old drug warehouses.[1]

Resin of Styrax officinale L.; *True Storax*—This was a solid resin somewhat resembling benzoin, of fragrant, balsamic odour, held in great estimation from the time of Dioscorides and Pliny down to the close of the last century. It was obtained from the stem of *Styrax officinale* L. (*Styraceæ*), a native of Greece, Asia Minor and Syria, now found also in Italy and Southern France. This plant when permitted to grow freely for several years, forms a small tree, in which state alone it appears to be capable of affording a fragrant resin. But in most localities it has been reduced by ruthless lopping to a mere bush, the young stems of which yield not a trace of exudation. True storax has thus utterly disappeared, and genuine specimens of it are scarcely to be found even in museums.

Professor Krinos of Athens has informed us (1871), that about Adalia on the southern coast of Asia Minor, a sort of solid storax obtained from *S. officinale* is still used as incense in the churches and mosques. The specimen of it which he has been good enough to send us, is not however resin, but *sawdust;* it is of a pale cinnamon-brown and pleasant balsamic odour. By keeping, it emits an abundance of minute acicular crystals (styracin?). The substance is interesting in connexion with the statement of Dioscorides, that the resin of *Styrax* is adulterated with the *sawdust of the tree itself,* and the fact that the region where this sawdust is still in use, is one of the localities for the drug (Pisidia) which he mentions.

Resin of Liquidambar styraciflua L.—a large and beautiful tree native of North America from Connecticut and Illinois southward to Mexico and Guatemala. In the United States, where it is called *Sweet Gum*, the tree yields from natural fissures or by incision, small quantities of a balsamic resin. In Central America this exudation is far more freely produced; an authentic specimen from Guatemala in our possession, is a pale yellow, opaque resin of honey-like consistence, becoming transparent, amber-coloured and brittle by exposure to the air. It has a rather terebinthinous, balsamic odour. In the mouth it softens like benzoin or mastich, and has but little taste. Another specimen also from Guatemala, is a thick, fluid oleo-resin, perfectly transparent and of a golden brown hue.

The resin of *L. styraciflua* L. has been ascertained by Procter to contain cinnamic, but not benzoic acid. Whether it is capable of yielding styrol is not known.

Resin of Liquidambar Formosana Hance—This tree, which I suppose may be the *Styrax liquida folio minore* which Ray names[2] as occurring in a collection of plants from Amoy, is a native of Formosa and Southern China, where it affords a dry terebinthinous resin, of agreeable fragrance when heated. Of this resin, which is used by the Chinese, a specimen collected in Formosa by Mr. Swinhoe has been presented

[1] The *Storax noir* of Guibourt (*Hist. des Drogues*, éd. 4. ii. 554) is one of these.

[2] *Hist. Plant.* iii. (1704), appendix p. 8.

:ooker. A tree figured under the name of *Fung-heang* in the
, we presume, this species.

f Altingia excelsa Noronha (*Liquidambar Altingiana* Bl.),
of the Javanese and Malays—The *Rasamala* is a magnificent
Indian Archipelago, Burma, and Assam. In Java it yields
in the trunk an odorous resin, yet only very slowly and in
quantity; this resin is not collected.[2] In Burma, on the
the tree affords a fragrant balsam, of which according to
re are two varieties, the one pellucid and of a light yellowish
ned by simple incision; the other thick, dark, opaque, and
inous odour, procured by boring the stem and applying fire
runk.

MYRTACEÆ.

OLEUM CAJUPUTI.

iput, Kayu-puti Oil; F. *Essence de Cajeput;* G. *Cajeputöl.*

al Origin—*Melaleuca Leucadendron* L., a tree often attaining
le size, with a thick spongy bark peeling off in layers, and
n pendulous branches. It is widely spread, and abundant
n Archipelago and Malayan peninsula, and is also found in
istralia, Queensland and New South Wales.

, according to Bentham,[4] varies exceedingly in the size,
exture of the leaves, in the young shoots being silky, and
silky-villous or woolly, or the whole quite glabrous, in the
nse, or long and interrupted spikes, in the size of the flower,
greenish-yellow, whitish, pink, or purple stamens, so that
lt to believe all can be forms of a single species. Yet
ation, none of these variations are sufficiently constant or so
to allow of the definition of distinct races.

ety growing in Bouro, where the oil of cajuput has been
r since the time of Rumphius, and known as *M. minor*
scribed by Lesson who visited the island in 1823, as a tree
n aged olive, with flowers in little globose white heads, and
stout bark of which is composed of numerous satiny layers.

—Rumphius who passed nearly fifty years in the Dutch
in the East Indies, and died at Amboyna in 1702, is the
an account of the oil under notice, and of the tree from
obtained.[5] From what he says, it appears that the aromatic
f the tree were well known to the Malays and Javanese,
the habit of steeping its leaves in oil which they then im-
ith the smoke of benzoin and other aromatics, so obtaining
iquid for anointing their heads. They likewise used cushions
the leaves, and also laid the latter in chests to keep away

rance of the foliage having thus attracted the attention of the

t. 5. § 1. *Aromatic Trees.*—
g., see Hooker's *Icones Plant.*
. 1020.
letter to D. Hanbury, dated

[3] *Pharm. of India*, 1868, 88.
[4] *Flora Australiensis*, iii. (1866) 142.
[5] *Herb. Amboinense*, ii. (1741) cap. 26.

Dutch, probably suggested submitting the leaves to distillation. Rumphius narrates how the oil was obtained in very small quantities, and was regarded as a powerful sudorific.

The oil was first in the hands of the Amsterdam druggists about the year 1727,[1] soon after which period it took the name of *Oleum Wittnebianum*, from the recommendations bestowed on it by M. von Wittneben, a German clergyman long resident in Batavia.[2] In France and England it was however scarcely known till the commencement of the present century, though it had a place in the Edinburgh Pharmacopœia of 1783. In the *London Price Current*, we do not find it quoted earlier than 1813, when the price given is 3*s.* to 3*s.* 6*d.* per ounce, with a duty of 2*s.* 4½*d.* per ounce.

Manufacture—In the island of Bouro, in the Molucca Sea, the leaves of the *Kayu-puti* or *White-wood* trees are submitted to distillation with water, the operation being conducted in the most primitive manner. Bickmore,[3] an American traveller who passed three months in the island in 1865, states that it produces about 8,000 bottles of the oil annually, and that this is almost its only export. The Trade Returns of the Straits Settlements published at Singapore, show that the largest quantity is shipped from Celebes, the great island lying west of Bouro.

Description—Oil of Cajuput is a transparent mobile fluid, of a light blueish-green hue, a fragrant camphoraceous odour, and bitterish aromatic taste. It has a sp. gr. of 0·926, and remains liquid even at 13° C. It deviates the ray of polarized light to the left.

Chemical Composition—The researches of Schmidl (1860) and of Gladstone (1872) have shown that cajuput oil consists chiefly of *Bihydrate of Cajuputene* or *Cajuputol*, $C^{10}H^{16},H^2O$, which may be obtained from the crude oil by fractional distillation at 174° C. If it is repeatedly distilled from anhydrous phosphoric acid, *Cajuputene*, $C^{10}H^{16}$, passes over at 160–165° C.; it has an agreeable odour of hyacinths. After the cajuputene, *Isocajuputene* distils at 177°, and *Paracajuputene* at 310–316°, both agreeing in composition with cajuputene.

Like most essential oils having the formula $C^{10}H^{16}$, crude cajuput oil is capable of forming the crystallized compound $C^{10}H^{16}, 3H^2O$. This we have obtained by adding to the oil double its weight of dilute sulphuric acid, about sp. gr. 1·09, and shaking the two liquids together occasionally during a few weeks. Various crystalline compounds of cajuputene with chlorine, bromine and iodine have also been obtained.[4]

By the action of concentrated boiling nitric acid, cajuput oil yields, according to Schwanert, chiefly camphretic acid and not camphoric.

The remarkable green tint of the oil is due in part to copper, a minute proportion of which metal is usually present in all that is imported.[5] It may be made evident by agitating the oil with dilute hydrochloric acid. To the acid, after it has been put into a platinum capsule, a little zinc should be added, when the copper will be immediately deposited.

[1] Schendus van der Beck, *De Indiæ rarioribus, Act. Nat. Cur.* i., appendix (1725) 123.

[2] Goetz, *Olei Caieput historia—Commercium Litterarium*, 1731. 3; Martini, *De Oleo Wittnebiano dissertatio*, 1751.

[3] *Travels in the East Indian Archipelago*, Lond. 1868. 282.

[4] Gmelin, *Chemistry*, xiv. (1860) 514.

[5] Histed in *Pharm. Journ.* April 6, 1872 804.

: platinum. The liquid may be then poured off and the copper red and tested. When the oil is rectified, it is obtained colourless, readily becomes green if in contact for a short time with metallic r. Guibourt[1] has however proved by experiment, that the volatile ıtained by the distillation of the leaves of several species of ıuca, *Metrosideros* and *Eucalyptus*, has naturally a fine green hue. ıot improbable that this hue is transient, and that the contamination copper is intentional in order to obtain a permanent green.

ommerce—The oil is imported from Singapore and Batavia, packed ss beer or wine bottles. From official statements[2] it appears that nports into Singapore during 1871 were as under:—

From Java	445	gallons
,, Manilla	200	,,
,, Celebes	3,895	,,
,, other places	350	,,
Total	4,890	,,

is large quantity, the greater portion was re-shipped to Bombay, tta, and Cochin China.

ses—Cajuput oil is occasionally administered internally as a ant, antispasmodic and diaphoretic: externally as a rubefacient it requent use.

ıbstitutes—The oil of *Eucalyptus oleosa* F. Muell. has, we find, lour of cajuput; and according to Gladstone it agrees, as well as ls of *Melaleuca ericifolia* Sm. and *M. linariifolia* Sm., almost ly with cajuput oil, except in optical properties. The same is ıly the case with the oil of *Eucalyptus globulus* Labil., which (1870) states to be dextrogyre.

CARYOPHYLLI.

Cloves; F. *Girofles, Clous de Girofles*; G. *Gewürznelken*.

ıtanical Origin—*Eugenia caryophyllata* Thunberg (*Caryophyllus ticus* L.), a beautiful evergreen tree, 30 to 40 feet high, resembling ntic myrtle, bearing numerous flowers grouped in small terminal omous cymes. The flower has an inferior ovary about ½ an inch ylindrical, of a crimson colour, dividing at the top into 4 sepals; round concave petals larger than the calyx, imbricated in the bud globe, but at length spreading and soon dropping off.

e clove-tree is said to be strictly indigenous only in the five small constituting the proper Moluccas, namely Tarnati, Tidori, Mortir, an and Bachian.[3] These form a chain on the west side of the sland of Jilolo, where, strange to say, the tree appears not to exist ld state (Crawfurd). According to Rumphius, it was introduced into

[1] *des Drog.* iii. (1869) 278.

[2] *Book of the Colony of the Straits ts for* 1871, Singapore 1872.

[3] Though these are the original Moluccas or Clove Islands, the name has been extended to all islands east of Celebes and west of New Guinea.

Amboyna before the arrival of the Portuguese, and is still cultivated there and in the neighbouring islands of Haruku, Saparua and Nusalaut, also in Sumatra and Penang. It is likewise now found in Malacca, the Mascarene Islands, the islands of Zanzibar and Pemba on the eastern coast of Africa, and the West Indies.

The tree which is grown for the spice appears to be a cultivated variety, of lower stature and more aromatic than the wild form.

History—The Greek name Καρυόφυλλον is supposed to refer to the ball-like *petals* of the bud, which as above described, might be compared to a small nut (κάρυον). But the name is very variably written, as γαροῦμφουλ, καρφούφουλ, γαρόφαλα,[1] whence it becomes probable that it is not really Greek, but an Asiatic word hellenized.

Cloves have been long known to the Chinese. Mr. Mayers, late Chinese Secretary to the British Legation at Pekin, has communicated to us the interesting fact that they are mentioned by several Chinese writers as in use under the Han dynasty, B.C. 266 to A.D. 220, during which period it was customary for the officers of the court to hold the spice in the mouth before addressing the sovereign, in order that their breath might have an agreeable odour.[2]

The first European author to mention *Caryophyllon* is Pliny, who describes it after *pepper*, as a grain resembling that spice but longer and more brittle, produced in India, and imported for the sake of its odour. It is doubtful whether this description really refers to cloves.

By the 4th century, cloves must have become well known in Europe, if credence can be placed in a remarkable record preserved by Vignoli,[3] which states that the emperor Constantine presented to St. Silvester, bishop of Rome, A.D. 314–335, numerous vessels of gold and silver, incense and spices, among which last were 150 pounds of *Cloves*,—a vast quantity for the period.

Cosmas Indicopleustes[4] in his *Topographia Christiana* written about A.D. 547, states in the account of Taprobane (Ceylon) that silk, aloes[-wood], cloves (Καρυόφυλλον) and sandal wood, besides other productions, are imported thither from China and other emporia, and transmitted to distant regions. A century later, Paulus Ægineta[5] distinctly described cloves as *Caryophyllon—ex India, veluti flores cujusdam arboris . . odorati, acres. . .* and much used for a condiment and in medicine.

In the beginning of the 8th century, the same spice is noticed by Benedictus Crispus,[6] archbishop of Milan, who calls it *Cariophylus ater;* and in A.D. 716, it is enumerated with other commodities in the diploma granted by Chilperic II. to the monastery of Corbie in Normandy.[7]

We find cloves among the wares on which duty was levied at Acon (the modern Acre) in Palestine at the end of the 12th century, at which period that city was a great emporium of Mediterranean trade.[8] They

[1] Langkavel, *Botanik der späteren Griechen*, Berlin, 1866. 19.

[2] At this period, the clove was called *Ki shêk hiang*, i.e. *fowl's tongue spice*. The modern name *Ting hiang*, i.e. *nail-scent* or *-spice*, was in use in the 5th or 6th century of our era.

[3] *Liber Pontificalis, seu de Gestis Romanorum Pontificum*, Romæ, i. (1724) 94.

[4] Migne, *Patrologiæ Cursus*, series Græca, lxxxviii. (1860) 446.

[5] *De re medica*, lib. vii. c. 3.

[6] *Pomatium Medicum*—Migne, *Patrologiæ Cursus*, lxxxix. (1850) 374.

[7] Pardessus, *Diplomata, Chartæ*, etc., ii. (1849) 309.

[8] *Recueil des Historiens des Croisades. Lois*, ii. (1843) 173.

rise enumerated in the tariff of Marseilles of A.D. 1228,[1] in that lona of 1252[2] and of Paris, 1296.[3]

e facts show that the spice was a regular object of commerce at od. But it was very costly: the Household Book of the Countess ster A.D. 1265[4] gives its price as 10*s.* to 12*s.* per lb., exactly the that of saffron. Several other examples of the high cost of the ght be adduced.

ie place of growth of cloves, the first distinct notice seems to be the Arabian geographer Ibn Khurdádbah,[5] A.D. 869–885, who ie spice, with cocoa-nuts, sugar, and sandal-wood as produced in Doubtless he was misinformed, for the clove-tree had not come so at that period. Marco Polo[6] made the same mistake four cen- ter: finding the spice in Java, he supposed it the growth of the

lo Conti,[7] a Venetian merchant who reached the Indian Archi- n the middle of the 15th century, learned that cloves are brought from the island of Banda, fifteen days' sail further east. e arrival of the Portuguese at the commencement of the 16th more accurate accounts of the Spice Islands began to reach and Pigafetta,[8] the companion of Magellan, gave a very good on of the clove-tree as he observed it in 1521.

Portuguese had the principal share in the clove trade for nearly y. In 1605 they were expelled by the Dutch, who took exclu- session of the Moluccas and adopted extraordinary measures for the traffic in their own hands. Yet notwithstanding this, large of cloves reached England direct. In 1609 a ship of the East ompany called the *Consent*, arrived with 112,000 lb. the duty on nounted to £1400 and the impost to as much more. The spice d was sold at 5*s.* 6*d.* and 5*s.* 9*d.* per lb.—of course, in bond.[9]

ffect their purpose, the Dutch endeavoured to extirpate the clove- n its native islands, and even instituted periodical expeditions purpose of destroying any young trees that might have acci- sprung up. This policy the object of which was to confine the of the spice to a group of small islands of which Amboyna is the nas but very recently been abandoned: though the cultivation of was free in all other localities, the *clove parks* of the Amboyna emained the property of the Dutch Government. The original s or Clove Islands now produce no cloves at all.

enterprise of Poivre, the French governor of Mauritius and , so far eluded the vigilance of the Dutch, that both clove- and trees were introduced into those islands in the year 1770.[10] The

t Guindon, *Hist. des Actes . . . . capitulité de Marseille*, 1841. 373.

ny, *Memorias sobre la marina celona*, iii. 170.

d'Arcq, *Revue archéologique*, ix.

rs and Household Expenses in Roxburgh Club), 1841. lii.

ere des routes et des provinces, r C. Barbier de Meynard, *Journ.* 6. tome v. (1865) 227.

Marco Polo, ii. (1871) 217.—It rever be borne in mind that the was applied in a general sense by the Arab geographers to the islands of the Archipelago.

[7] Kunstmann, *Die Kenntniss Indiens im XVten Jahrhundert*, Munchen 1863. 46.

[8] Ramusio, *Delle navigationi et viaggi*, Venetia 1554, fol. 404*b*.

[9] *Calendar of State Papers, Colonial series, East Indies*, 1862. 181.

[10] Tessier, *Sur l'importation du Girofler des Moluques aux Isles de France, de Bourbon et de Sechelles, et de ces Isles à Cayenne.—Observations sur la physique*, Paris, Juillet, 1779.

clove-tree was carried thence to Cayenne in 1773, and to Zanzibar about the end of the century.

Crawfurd[1] in an excellent article of which we have made free use, aptly remarks that it is difficult to understand how the clove first came to the notice of foreign nations, considering the well-ascertained fact that it has never been used as a condiment or in any other way, by the inhabitants of the islands of which it is a native. We may observe however that there were some singular superstitions among the islanders with regard to the so-called *Royal Clove* (p. 255), a tree of which on the island of Makiyan was long supposed to be unique.

Collection—The flower-buds of the clove-tree when young are nearly white, but afterwards become green and lastly bright red, when they must at once be gathered. This in Zanzibar is done by hand; each clove is picked singly, a moveable stage the height of the tree being used to enable the labourers to reach the upper branches. The buds are then simply dried in the sun, by which they acquire the familiar dark brown tint of the commercial article. The gathering takes place twice a year; in the Moluccas where the harvest occurs in June and December, the cloves are partly gathered by hand, and partly beaten off the tree by bamboos on to cloths spread beneath. The annual yield of a good tree is about 4½ pounds, but sometimes reaches double that quantity.

Description—Cloves are about $\frac{1}{10}$ of an inch in length, and consist of a long cylindrical calyx dividing above into 4 pointed spreading sepals which surround 4 petals, closely imbricated as a globular bud about $\frac{1}{10}$ of an inch in diameter.

The petals which are of lighter colour than the rest of the drug and somewhat translucent from numerous oil-cells, spring from the base of a 4-sided epigynous disc, the angles of which are directed towards the lobes of the calyx. The stamens which are very numerous, are inserted at the base of the petals and are arched over the style. The latter which is short and subulate, rises from a depression in the centre of the disc. Immediately below it and united with the upper portion of the calyx is the ovary, which is 2-celled and contains many ovules. The lower end of the calyx (*hypanthium*) has a compressed form; it is solid but has its internal tissue far more porous than the walls. The whole calyx is of a deep rich brown, has a dull wrinkled surface, a dense fleshy texture, and abounds in essential oil which exudes on simple pressure with the nail. Cloves have an agreeable spicy odour, and a strong biting aromatic taste.

The varieties of cloves occurring in commerce do not exhibit any structural differences. Inferior kinds are distinguished by being less plump, less bright in tint, and less rich in essential oil. In London price-currents, cloves are enumerated in the order of value thus: Penang, Bencoolen, Amboyna, Zanzibar.

Microscopic Structure—A transverse section of the lower part of a clove shows a dark rhomboid zone, the tissue on either side of which is of a lighter hue. The outer layer beneath the epidermis exhibits a large number of oil-cells, frequently as much as 300 mkm. in diameter. About 200 oil-cells may be counted in one transverse section, so that the

[1] *Dictionary of the Indian Islands*, 1856, article *Clove*.

rge amount of essential oil in the drug is well shown by its microscopic haracters. The above-mentioned zone is chiefly made up of about 30 bro-vascular bundles, another stronger bundle traversing the centre of he clove. The fibro-vascular bundles as well as the tissue bordering he oil-cells, assume a greenish black hue by alcoholic perchloride of iron.

Chemical Composition—Few plants possess any organ so rich in ssential oil as the drug under consideration. The oil known in pharnacy as *Oleum Caryophylli*, which is the most important constituent of loves, is obtainable to the extent of 16 to 18 per cent. But to extract he whole, the distillation must be long continued, the water being eturned to the same material.

The oil is a colourless or yellowish liquid with a powerful odour and aste of cloves, sp. gr. 1·046 to 1·058, and no rotatory power. It is a ixture of a hydrocarbon, and an oxygenated oil called *Eugenol*, in varible proportions. The former which is sometimes termed *light oil of loves* and comes over in the first period of the distillation, has the comosition of oil of turpentine, a sp. gr. of 0·91, and boils at 251° C. It herefore agrees better with the oils of copaiba and cubebs, to which we ssign more correctly the formula $C^{20}H^{32}$ than $C^{10}H^{16}$. Eugenol which n account of its acid properties is commonly called *Eugenic Acid*, has a p. gr. of 1·068 and possesses the full taste and smell of cloves. Its oiling point is about 252° (242° Stenhouse). With alkalis, especially mmonia and baryta, it yields crystallizable salts. Eugenic acid, $C^{10}H^{12}O^2$, isomeric with cuminic acid, but it partakes in several respects of the hemical behaviour of phenol, as for instance in not reddening litmus. s is likewise a constituent of the volatile oils of pimento, cinnamonaf, cannella alba, and Brazilian clove-bark (*Dicypellium caryophyllatum* ees).

The water distilled from cloves contains in addition to the essential l, another body, *Eugenin*, which sometimes separates after a while in he form of tasteless, crystalline laminæ, having the same composition as ugenic acid.[1] We have never met with it.

Scheuch (1863) showed that oil of cloves also contains *Salicylic Acid*, $^{7}H^{6}O^{3}$, probably in the form of an ether. It may be removed by aking the oil with a solution of carbonate of ammonium. To the resence of this acid, the reactions of the oil with iron are probably due. rude oil of cloves indeed assumes a greenish-blue hue when mixed ith an alcoholic solution of perchloride of iron, and an intense violet if aken with reduced metallic iron.

Caryophyllin, $C^{10}H^{18}O$, is a neutral, tasteless, inodorous substance, omeric with common camphor, crystallizing in needle-shaped prisms. e have obtained it in small quantity, by treating with boiling ether oves, which we had previously deprived of most of their essential oil small quantities of alcohol. E. Mylius (1873) obtained from it by tric acid, crystals of *Caryophyllinic Acid*, $C^{20}H^{32}O^6$.

Carmufellic Acid obtained by Muspratt and Danson after digesting aqueous extract of cloves with nitric acid, is a product of this treatnt and not a natural constituent of cloves.

Cloves contain a considerable proportion of gum; also a tannic acid yet particularly examined.

[1] Gmelin, *Chemistry*, xiv. (1860) 201.

Production and Commerce—Of late years the principal *locality* for the production of cloves has been the islands of Zanzibar and Pemba on the east coast of Africa, which until very recently were capable of producing a maximum crop of 10½ millions of pounds in a single season. On the 15th April, 1872, Zanzibar was visited by a hurricane of extraordinary violence, by which about five-sixths of the clove-trees in the island were destroyed; and although the plantations are being renewed, many years must elapse before the crop can resume its former importance. Pemba which is distant from Zanzibar 25 miles, and produced about half as much of the spice as that island, did not appreciably suffer from the storm.

The crop on these islands fluctuates, a good year alternating with a bad one. This is partly shown in the imports of Bombay, the great mart of Zanzibar produce, which have been as follows:—

1869-70	1870-71	1871-72	1872-73
45,642 cwt.	21,968 cwt.	43,891 cwt.	25,185 cwt.

The quantity of cloves shipped from Bombay to the United Kingdom is comparatively small, being in 1871–72, 3279 cwt.; in 1872-73, 3271 cwt.

Cloves are also largely shipped direct from Zanzibar to the United States and Hamburg. A small amount is taken in native vessels to the Red Sea ports; these are packed in raw hides. Those for the European and American markets are shipped in mat bags made of split cocoa-nut leaf.

The clove trade of the Moluccas has been for many years in the hands of the Dutch Government, which by its restrictive policy, assumed practically the position of growers, disposing of their produce through the Netherlands Trading Company at auctions held in Holland twice a year. This system which was abolished in 1872, has proved disastrous to the trade it was designed to protect, and to such a degree that the produce of cloves in the Moluccas is but a tenth of what it was in the early days of their intercourse with Europe. The crop of the four islands, Amboyna, Haruku, Saparua, and Nusalaut, the only Moluccas in which the tree is cultivated, was reckoned in 1854 as 510,912 lb.

The export of cloves from Java in 1871, was 1397 peculs[1] (186,266 lb.). The French island of Réunion which thirty or forty years ago used to produce as much as 800,000 kilogrammes (1,764,571 lb.) now yields almost none, partly by reason of change of climate and partly from political causes.

Uses—As a remedy, cloves are unimportant, though in the form of infusion or distilled water, they are useful in combination with other medicines. The essential oil which sometimes relieves toothache, is a frequent ingredient of pill-masses. The chief consumption of cloves is as a culinary spice.

Substitutes—1. *Clove Stalks—Festuca* vel *Stipites Caryophylli*, in French *Griffes de Girofle*, in German *Nelkensticle*, were an article of import into Europe during the middle ages, when they were chiefly known by their low Latin name of *fusti*. Thus under the statutes of Pisa,[2] A.D. 1305, duty was levied not only on cloves (*garofali*), but also

[1] *Consular Reports*, Aug. 1873. 952.

[2] Bonaini, *Statuti inediti della città di Pisa dal xii. al xiv. secolo*, iii. (1857) 104.

usti garofalorum. Pegolotti[1] a little later, names both as
; of trade at Constantinople. Clove *Leaves* are enumerated[2]
into Palestine in the 12th century; they are also mentioned
he drugs sold at Frankfort[3] about the year 1450: we are
it they are used in modern times.

ve Stalks, they are still a considerable object of trade, espe-
Zanzibar, where they are called by the natives *Vikunia.*
olerably aromatic, and yield 4 to 5 per cent. of vola-
y are used for adulterating the *Ground Cloves,* sold by
ch an admixture may be detected by the microscope,
the powder after treatment with potash, be examined in
clove stalks have been ground, thick-walled or stone-cells
in the powder; such cells do not occur in cloves. Powdered
o an adulterant of powdered cloves; it also contains stone-
addition numerous starch-granules which are entirely
loves.

r *Cloves, Anthophylli,*—are the *fruits* of the clove-tree,
-oblong berries about an inch in length and much less rich
oil than cloves. Though occasionally seen in the London
some quantity, they are not an article of regular import.[4]
ain very large starch-granules, their presence as an adultera-
d cloves would be revealed by the microscope.

Cloves—Under this name or *Caryophyllum regium,* a
trosity of the clove was formerly held in the highest reputa-
ount of its rarity and the strange stories told respecting it.[5]
our possession show it to be a very small clove, distinguished
nal number of sepals and large bracts at the base of the
he corolla and internal organs being imperfectly developed.

FRUCTUS PIMENTÆ.

ai; Pimento, Allspice, Jamaica Pepper; F. *Poivre de la*
Piment des Anglais, Toute-épice; G. *Nelkenpfeffer,*
fe, Neugewürz.

al Origin—*Pimenta officinalis* Lindley[6] (*Myrtus Pimenta*
Pimenta DC.), a beautiful evergreen tree, growing to about
ight, with a trunk 2 feet in circumference, common through-
; India Islands. In Jamaica, it prefers limestone hills near
is especially plentiful on the north side of the island.

—The high value placed on the spices of India, sufficiently
interest with which aromatic and pungent plants were
the early explorers of the New World; while the eager
tain these lucrative commodities is shown by the names

note 1.
Historeans des Croisades,
73.
Die Frankfurter Liste, Halle,

the fortnightly price cur-
on drug-broker under date
he announcement of the sale
Mother Cloves at 2*d.* to 3*d.*
per lb., besides 4,200 packages of Clove
Stalks at 3*d.* to 4*d.* per lb.

[5] Rumphius, *Herb. Amb.* ii. 11. tab. 2.—
See also Hasskarl, *Neuer Schlüssel zu*
Rumph's Herb. Amb., Halle, 1866; Berg,
Linnæa, 1854. 137; Valmont de Bomare,
Dict. d'Hist. Nat. iii. (1775) 70.

[6] *Collectanea Botanica,* 1821, sub. tab. 19.

Pepper, Cinnamon, Balsam, Melegueta, Amomum, bestowed on productions totally distinct from those originally so designated.

Among the spices thus brought to the notice of Europe, were the little dry berries of certain trees of the myrtle tribe, which had some resemblance in shape and flavour to peppercorns, and hence were named *Pimienta,*[1] corrupted to *Pimenta* or *Pimento.* It was doubtless a drug of this kind, if not our veritable allspice, that was given to Clusius in 1601 by Garret, a druggist of London, and described and figured by the former in his *Liber Exoticorum.*[2] A few years later it began to be imported into England, being as Parkinson[3] says—"obtruded for *Amomum*" (*Round Cardamom*), so that "some more audacious than wise . . . put it in their compositions instead of the right." Sloane[4] states (1691) that it was commonly sold by druggists for *Carpobalsamum.* Ray (1693) distinguished the spice as a production of Jamaica under the name of *Sweet-scented Jamaica Pepper* or *All-spice,* and states it to be abundantly imported into England, and in frequent use as a condiment, though not employed in medicine. The spice had a place in the London Pharmacopœia as early as 1721.

The consumption of pimento has been enormous. In the year 1804–5, the quantity shipped from the British West Indies was 2,257,000 ℔., producing in import duty, a net revenue of £38,063.[5]

Production and Commerce—The spice found in commerce is furnished wholly by the island of Jamaica. A plantation, there called a *Pimento walk,* is a piece of natural woodland stocked with the trees which require but little attention. The flowers appear in June, July and August, and are quickly succeeded by the berries, which are gathered when of full size but still unripe. This is performed by breaking off the small twigs bearing the bunches. These are then spread out, and exposed to the sun and air for some days, after which the stalks are removed, and the berries are fit for being packed.

By an official document[6] it appears that in the year 1871, the amount of land in Jamaica cropped with pimento was 7,178 acres. In that year the island exported of the spice 6,857,838 ℔., value £28,574. Of this quantity Great Britain took 4,287,551 ℔., and the United States 2,266,950 ℔.

Description—Allspice is a small, dry, globular berry, rather variable in size, measuring $\frac{3}{10}$ to less than $\frac{2}{10}$ of an inch in diameter. It is crowned by a short style, seated in a depression, and surrounded by a short thick sepals; generally however the latter have been rubbed off, a scar-like raised ring marking their former position. The berry has a woody shell or pericarp, easily cut, of a dark ferruginous brown, and rugose by reason of minute tubercles filled with essential oil. It is two-celled, each cell containing a single, reniform, exalbuminous seed having a large spirally curved embryo. The seed is aromatic, but less so than the pericarp.

Allspice has an agreeable, pungent, spicy flavour, much resembling that of cloves.

[1] *Pimienta,* the Spanish for *pepper* is derived from *pigmentum,* a general name in mediæval Latin for *spicery.*

[2] Lib. i. c. 17.

[3] *Theatrum Botanicum* (1640) 1567.

[4] *Description of the Pimienta or Jamaica Pepper-tree.—Phil. Trans.* xvii. No. 192.

[5] *Parliamentary Return,* March 18[illegible] quoted in Young's *West-India Common-place Book,* 1807. 79.

[6] *Blue Book* for Jamaica, printed 1872.

Microscopic Structure—The outer layer of the pericarp immedi-
y beneath the epidermis, contains numerous large cells filled with
ntial oil. The parenchyme further exhibits thick-walled cells loaded
ı resin, and smaller cells enclosing crystals of oxalate of calcium.
whole tissue is traversed by small fibro-vascular bundles. The seeds
also provided with a small number of oil-cells, and contain starch
ıules.

Chemical Composition—The composition of pimento resembles in
ıy points that of cloves. The berries yield to the extent of 3 to 4½
cent.,[1] a volatile oil, sp. gr. 1·037 (Gladstone), having the character-
: taste and odour of the spice, and known in the shops as *Oleum*
ıentæ. We have found it to deviate the ray of polarized light 2° to
left, when examined in a column of 50 mm. The rotatory power
ends upon the presence of a hydrocarbon, the eugenic acid being
cally inert.

Oeser (1864), whose experiments have been confirmed by Gladstone
'2), has shown that oil of pimento has substantially the same
position as oil of cloves. When it is heated in a retort, the first
ion that distills over is a hydrocarbon lighter than water, the second
ugenic acid, wholly soluble in alkalis and giving crystalline salts
253). Salicylic acid has not been found. Pimento is rich in tannin,
:ing with a persalt of iron an inky black. Its decoction is coloured
ı blue by iodine, showing the presence of starch. Dragendorff (1871)
ted out the existence in allspice of an extremely small quantity of
lkaloid.

Jses—Employed as an aromatic like cloves; a distilled water
ıa Pimentæ) is frequently prescribed. The chief use of pimento
a culinary spice.

Substitutes—According to Berg[2] the Mexican spice called *Pimienta*
abasco (? *Piment Tabago*, Guibourt) which is somewhat larger and
aromatic than Jamaica allspice, is derived from a variety of *Pimenta*
ıalis. Analogous products are afforded by *Pimenta acris* Wight
P. Pimento Griseb.

GRANATEÆ.

CORTEX GRANATI FRUCTUS.

Cortex Granati; Pomegranate Peel; F. *Ecorce de Grenades;*
G. *Granatschalen.*

Botanical Origin—*Punica Granatum* L., a shrub or low tree, with
i deciduous foliage and handsome scarlet flowers. It appears to be
enous to North-western India, and the countries south and south-

om information kindly given us by
ı. Herrings and Co., London, it ap-
that 3756 lb. of pimento distilled in
urse of several years, yielded 120 lb.
f oil, equivalent to 3·19 per cent.—
Mr. Whipple distilled in the laboratory of
Messrs. Barron and Co., 896 lb., getting the
exceptionally large yield of 4·6 per cent.

[2] *Pharmazeutische Waarenkunde* 1869. 394.

west of the Caspian to the Persian Gulf and Palestine. But it has long been cultivated, and is now found throughout the warm parts of Europe and in the subtropical regions of both hemispheres.

History—The pomegranate has been highly prized by mankind from the remotest antiquity, as is shown by the references to it in the Mosaic writings;[1] and by the numerous representations of the fruit in the sculptures of Persepolis and Assyria,[2] and on the ancient monuments of Egypt.[3] It was probably introduced into the south of Italy by Greek colonists, and is named as a common fruit-tree by Porcius Cato[4] in the 3rd century B.C. The peel of the fruit was recognized as medicinal by the ancients, and among the Romans was in common use for tanning leather.

Description—The fruit of the pomegranate tree is a spherical, somewhat flattened and obscurely six-sided berry, of the size of a common orange and often much larger, crowned by the thick, tubular, 5- to 9-toothed calyx. It has a smooth, hard, coriaceous skin, which when the fruit is ripe, is of a brownish yellow tint, often finely shaded with red. Membranous dissepiments about 6 in number meeting in the axis of the fruit, divide the upper and larger portion into equal cells. Below these, a confused conical diaphragm separates the lower and smaller half, which in its turn is divided into 4 or 5 irregular cells. Each cell is filled with a large number of grains, crowded on thick spongy placentæ, which in the upper cells are parietal but in the lower appear to be central. The grains, which are about $\frac{1}{2}$ an inch in length, are oblong or obconical and many-sided, and consist of a thin transparent vesicle containing an acid, saccharine, red, juicy pulp, surrounding an elongated angular seed.

The only part of the fruit used medicinally is the peel, *Cortex Granati* of the druggists, which in the fresh state is leathery. When dry, as imported, it is in irregular, more or less concave fragments, some of which have the toothed, tubular calyx still enclosing the stamens and style. It is $\frac{1}{20}$ to $\frac{1}{10}$ of an inch thick, easily breaking with a short corky fracture; externally it is rather rough, of a yellowish brown or reddish colour. Internally it is more or less brown or yellow, and honey-combed with depressions left by the seeds. It has hardly any odour, but has a strongly astringent taste.

Microscopic Structure—The middle layer of the peel consists of large thin-walled and elongated, sometimes even branched cells, among which occur thick-walled cells and fibro-vascular bundles. Both the outer and the inner surface are made up of smaller, nearly cubic and densely packed cells. Small starch granules occur sparingly throughout the tissue, as well as crystals of oxalate of calcium.

Chemical Composition—The chief constituent is tannin, which in an aqueous infusion of the dried peel, produces with perchloride of iron an abundant dark blue precipitate. The peel also contains sugar and a little gum. Dried at 100° C. and incinerated, it yielded us 5·9 per cent. of ash.

[1] *Exodus* xxviii. 33, 34, *Numbers* xx. 5, *Deut.* viii. 8.

[2] Layard, *Nineveh and its Remains*, ed. 2, ii. (1849) 296.

[3] Wilkinson, *Ancient Egyptians*, ii. (1837) 142.

[4] Nisard's edition, Paris, 1864, capp. 7. 127. 133.

Uses—Pomegranate peel is an excellent astringent, now almost ete in British medicine. Waring[1] asserts that when combined with n and an aromatic, as cloves, it is a most useful remedy in the ic dysentery of the natives of India, as well as in diarrhœa.

CORTEX GRANATI RADICIS.

Pomegranate-root Bark ; F. Ecorce de racine de Grenadier ; G. Granatwurzelrinde.

Botanical Origin—*Punica Granatum* L., see p. 257.

History—In addition to the particulars regarding the pomegranate given in the preceding article, the following which concern the drug r notice may be stated.

A decoction of the root of the pomegranate was recommended by is,[2] Dioscorides,[3] and Pliny[4] for the expulsion of tape-worm; but emedy had fallen into complete oblivion, until its use among the lus attracted the notice of Buchanan[5] at Calcutta about the year . This physician pointed out the efficacy of the root-bark, which further shown by Fleming and others. Pomegranate root is known ve been long used for a similar purpose by the Chinese.[6]

hough the medicine is admitted to be efficient, and is employed advantage in India where it is easily procured both genuine and , it is hardly ever administered in England, the extract of male-being generally preferred ; but it has a place in several continental macopœias.

Description—The bark occurs in rather thin quills or fragments, 3 inches long. Their outer surface is yellowish grey, sometimes marked fine longitudinal striations or reticulated wrinkles, but more often wed by bands of cork, running together in the thickest pieces into l flat conchoidal scales. The inner surface which is smooth or ed with fine striæ and is of a greyish yellow, has often strips of ough whitish wood attached to it. The bark breaks short and ilar ; it has a purely astringent taste, but scarcely any odour.

Microscopic Structure—On a transverse section, the liber is to be the prevailing part of the cortical tissue. The former consists ternating layers of two kinds of cells—one of them loaded with d crystals of oxalate of calcium, the other filled with starch granules tannic matter. The bark is traversed by narrow medullary rays, very large sclerenchymatous cells are scattered through the liber. hed with a dilute solution of a persalt of iron, the bark assumes a blackish blue tint.

Chemical Composition—The bark contains according to Wacken- (1824), more than 22 per cent. of tannic acid, which Rembold , has ascertained to consist for the most part of a peculiar variety l *Punico-tannic Acid*, $C^{20}H^{16}O^{13}$; when boiled with dilute sulphuric it is resolved into *Ellagic Acid*, $C^{14}H^{6}O^{8}$, and sugar. Punico-tannic

[1] ... *of India*, 1868. 93. 447.
[2] Medicina, lib. iv. c. 17.
[3] ... c. 153.
[4] ... xxiii. c. 60.
[5] *Edinb. Med. and Surg. Journ.*, iii. (1807) 22.
[6] Debeaux, *Pharmacie et Mat. Méd. des Chinois*, 1865. 70.

acid is accompanied by common tannic acid, yielding by mea sulphuric acid, gallic acid, which appears sometimes to pre-exi the bark. If a decoction of pomegranate bark is precipitate acetate of lead, and the lead is separated from the filtered liqui latter on evaporation yields a considerable amount of mannite. T probably the *Punicin* or *Granatin* of former observers. Amon substances hitherto detected in pomegranate bark, it will be seen there is none which explains its tænicide power.

Uses—A decoction followed by a purgative, is stated by W and others to be most efficient for the expulsion of tape-worm. The bark is said to be preferable to the dried.

Adulterations—The commercial drug frequently consists par entirely of the bark of the stem or branches, characterised by it abundant cork-formation, which exhibits longitudinal bands or rid light brownish cork, but not conchoidal exfoliations. The middle c layer is somewhat more developed, and contains in the outer deposits of chlorophyll. The cambial zone is not distinctly obser Such bark is reputed to be less active than that of the root, b are not aware that the fact has ever been proved.

The bark of *Buxus sempervirens* and of *Berberis vulgaris* are som similar to the drug under notice, but their decoctions are not affec salts of iron.

CUCURBITACEÆ.

FRUCTUS ECBALLII.

Fructus Elaterii ; Elaterium Fruit, Squirting Cucumber, Wild Cuc
F. *Concombre purgatif ou Sauvage ;* G. *Springgurke.*

Botanical Origin—*Ecballium*[2] *Elaterium* A. Richard (*Mom Elaterium* L.), a coarse, hispid, fleshy, decumbent plant without te having a thick white perennial root. It is common throughou Mediterranean region, extending eastward as far as Southern Russ Persia, and westward to Portugal. It succeeds well in Central E and is cultivated to a small extent for medicinal use at Mitcha Hitchin in England.

History—Theophrastus mentions the plant under notice l name of Σίκυος ἄγριος. It is also particularly noticed by Dioscoride explicitly describes the singular process for making elaterium (ἐλατ which was almost exactly like that followed at the present day.

The Wild or Squirting Cucumber was well known and cultiva gardens in England as early as the middle of the 16th century.[3]

Description—The fruit is ovoid-oblong, nodding, about 1 long, hispid from numerous short fleshy prickles terminating in elongated points. It is attached by a long scabrous peduncle, is and green while young, becoming slightly yellowish when mature

Indian Annals of Med. Science, vi. (1859); *Pharmacopœia of India*, 1868. 93.

[2] *Ecballium* from ἐκβάλλω, I expel, in allusion to the expulsion of the seed erroneously written *Ecbalium*.

[3] Turner's *Herball*, 1568, part i.

and contains numerous oblong seeds lodged in a very bitter pulp. The fruit when ripe separates suddenly from the stalk, e same moment the seeds and juice are forcibly expelled from ire left by the detached peduncle. This interesting phenomenon the process of exosmosis, by which the juice of the outer part iit gradually passes through the strong contractile tissue which central cavity, until the pressure becomes so great that the way at its weakest point. This point is that at which the is articulated with the fruit; and it is the sudden and powerful n of the elastic tissue when relieved from pressure, that occa- violent expulsion of the contents of the central cavity.

he preparation of the officinal elaterium, the fruit has to be while still somewhat immature, for the simple reason that it impossible to gather it so as to retain its all-important juice, if iite ripe. When it is sliced longitudinally as in making elaterium, he juice is expelled by virtue of the endosmotic action already , as can easily be seen on examining the contracted lining of the it.

a observes[1] that if the juice of a fruit is received on a plate of is seen to be nearly colourless and transparent. In a few iowever, by exposure to the air, it becomes slightly turbid, and iite coagula are formed in it. By slow evaporation, minute al crystals make their appearance: these are *elaterin*.

lry weather favours the development of the active principle of

oscopic Structure—The middle layer of the fruit is built up omewhat thick-walled cells, traversed by a few fibro-vascular The former abound in small starch grains, and also contain of albuminous matter.

ical Composition—The experiments of Clutterbuck (1819) iat the active properties of the elaterium plant reside chiefly, ot exclusively, in the juice that surrounds the seeds; and it is iice and to the medicinal product which it yields, that the of chemists has been hitherto directed.

iice obtained by lightly pressing the sliced fruits, is at first ind slightly turbid. After having been set aside a few hours, i deposit, which has to be collected on calico, rapidly drained le pressure between layers of bibulous paper and porous bricks, in a warm place. The substance thus obtained is the *Elaterium* acy.[3] The method recommended by Clutterbuck[4] involves no The juice of the sliced fruit is saved, and the pulp scooped he thumb of the operator, is thrown on a sieve and slightly ith pure water. From these liquors, elaterium is deposited.

ium occurs in irregular cake-like fragments, light, friable, and when new, of a bright, pale green, becoming by age greyish and g minute crystals on the surface. It has a herby tea-like

[1] *Mat. Med.* ii. (1853) 1745.

had to procure elaterium fruits in the very fine summer of 1868, that the people occupied in fruits had never suffered so severely from their work as in that year D. H.

[3] There is a genus of [illegible] found in [illegible] by Linnæus, also called *Elater* [illegible]

[4] *Lond. Med. Repository*, xiii (1820) 1.

odour and a very bitter taste. The produce is extremely small: 240 lb. of fruits gathered at Mitcham, 10 August 1868, yielded 4⅝ ounces of elaterium = 0·123 per cent.

Elaterium consists, according to Pereira, of *Elaterin*, to which the activity of the drug is due, contaminated with green colouring matter, cellular tissue, and starch, together with a little of the residue of the bitter liquor from which these substances were deposited. Yet, in our opinion this description is not applicable to the best varieties of elaterium. We have examined elaterium carefully prepared in the laboratory of Messrs. Allen and Hanburys, London, and a fine specimen imported from Malta. Both are devoid of starch, as well as of cellular-tissue, but were seen to be largely made up of crystals. The first sample contained 12 per cent. of water, and yielded after drying, 8·4 per cent. of ash.

The most interesting principle of elaterium is *Elaterin*, $C^{20}H^{28}O^{5}$, discovered about the year 1831 by Morries, and independently by Hennell. The best method of obtaining it, according to our experience, is to exhaust elaterium with chloroform. From this solution, a white crystalline deposit of elaterin is immediately separated by addition of ether. It should be washed with a little ether, and recrystallized from chloroform. We have thus obtained 33·6 per cent. of pure elaterin from the above-mentioned elaterium of London, and 27·6 per cent. from that of Malta. Elaterin crystallizes in hexagonal scales or prisms; it has an extremely bitter, somewhat acrid taste. It is readily soluble in boiling alcohol, amylic alcohol, bisulphide of carbon, or chloroform. Its alcoholic solutions are neutral and are not precipitated by tannin, nor by any metallic solution. It is but very little coloured by cold concentrated sulphuric acid.

Elaterin is the drastic principle of *Ecballium*; if to its boiling alcoholic solution, solid caustic potash is added, the liquid thus obtained, is stated by Buchheim (1872), to be no longer precipitable by water. The elaterin is then in fact converted into an acid body, which may be separated by supersaturating the solution with a mineral acid. The principle thus obtained has been found by Buchheim to be devoid of drastic power.

The fresh juice of the fruits was found by Köhler (1869) to contain 95 per cent. of water, 3 to 3·5 of organic and 1 to 1·6 of inorganic constituents. The same chemist observed that the percentage of elaterin gradually diminished as the season advanced, until in the month of September he was unable to obtain any of it whatever.

Walz (1859) found in the juice of the fruits and herb of *Ecballium* as well as in that of *Cucumis Prophetarum* L., a second crystallizable bitter principle, *Prophetin*, and the amorphous substances *Ecballin* or *Elaterin Acid*, *Hydro-elaterin*, and *Elateride*, all of which require further examination.[1] Prophetin is a glucoside,—not so the other principles. The four together constitute according to Walz, 8·7 per cent. of elaterium, which moreover contains about the same percentage of pectic matter.

Uses—Squirting cucumbers are only employed for making elaterium, which is a very powerful hydragogue cathartic.[2] Elaterin is not employed in medicine, but seeing how much elaterium is liable to vary from climate or season, it might probably be introduced into use with advantage.

[1] Gmelin's *Chemistry*, xvii. (1866) 365 367.

[2] Clutterbuck says ½ of a grain purges violently.

FRUCTUS COLOCYNTHIDIS.

th, Coloquintida, Bitter Apple; F. *Coloquinte;* G. *Coloquinthe.*

nical Origin—*Citrullus Colocynthis* Schrader (*Cucumis Colo-*
.)—The colocynth gourd is a slender scabrous plant with a
root, native of warm and dry regions in the Old World, over
has an extensive area.

nencing eastward, it occurs in abundance in the arid districts
unjab and Sind, in sandy places on the Coromandel coast, in
'ersia as far north as the Caspian, in Arabia (Aden), Syria, and in
:he Greek islands. It is found in immense quantities in Upper
d Nubia, and throughout North Africa to Morocco and Sene-
in the Cape de Verd Islands, and on maritime sands in the
t of Spain. Finally, it is said to have been collected in Japan.

ory—Colocynth was familiar to the Greek and Roman, as well
: Arabian physicians; and if we may judge by the mention of
Anglo-Saxon herbal of the 11th century,[1] was not then unknown
n. The drug was collected in Spain at an early period, as is
from an Arabic calendar of A.D. 961, lately published together
ancient Latin version.[2]

plant has been long cultivated in Cyprus, and its fruit is
d in the 14th century as one of the more important products
and.[3]

ription—The colocynth plant bears a gourd of the size and
an orange, having a smooth, marbled-green surface. It is some-
ported simply dried, in which case it is of a brown colour; but
usually it is found in the market, peeled with a knife and
t then forms light, pithy, nearly white balls, which consist of
internal pulp of the fruit with the seeds imbedded in it. This
early inodorous, but has an intensely bitter taste, perceptible by
f its dust when the drug is slightly handled. The balls are
more or less broken; when dried too slowly they have a light
lour.

eeds are disposed in vertical rows on 3 thick parietal placentæ,
roject to the centre of the fruit, then divide and turn back,
two branches directed towards one another. Owing to this
, the fruit easily breaks up vertically into 3 wedges in each of
e lodged 2 rows of dark brown seeds. The seeds, of which a
tains from 200 to 300, are of flattened ovoid form, $\frac{3}{10}$ of an
by $\frac{2}{10}$ broad, not bordered. The testa which is hard and thick,
s surface minutely granulated, is marked on each side of its
nted end by two furrows directed towards the hilum. The seed,
er *Cucurbitaceæ*, is exalbuminous, and has thick oily cotyledons,
an embryo with short straight radicle directed towards the

ynth fruits are mostly supplied by wholesale druggists, broken
aving the seeds removed, the drug in such case being called
Pulp or *Pith.*

oscopic Structure—The pulp is made up of large thin-walled

ar, *Leechdoms*, &c. i. (1864) 325.
ndrier de Cordoue, publié par R.
e, 1873. 92.

[3] De Mas Latrie, *Hist. de l'île de Chypre*, iii. (1852-61) 498.

parenchymatous cells, their outer layer consisting of rows of smaller cells more densely packed. The tissue is irregularly traversed by fibro-vascular bundles, and also exhibits numerous large intercellular spaces. The cells contain but an insignificant amount of minute granules, to which neither iodine nor a persalt of iron imparts any coloration. The tissue is not much swollen by water, although one part of the pulp easily retains from 10 to 12 parts of water like a sponge.

Chemical Composition—The bitter principle has been examined by Walz (1858). He treated alcoholic extract of colocynth with water, and mixed the solution firstly with neutral acetate of lead and subsequently with basic acetate of lead. From the filtered liquid the lead was separated by means of sulphuretted hydrogen, and then tannic acid added to it. The latter caused the colocynthin to be precipitated; the precipitate washed and dried was decomposed by oxide of lead, and finally the colocynthin was dissolved out by ether.

Walz thus obtained about ¼ per cent. of a yellowish mass or tufts, which he considered as possessing crystalline structure and to which he gave the name *Colocynthin*. He assigns to it the formula $C^{56}H^{94}O^{28}$, which in our opinion requires further investigation. Colocynthin is a violent purgative.

Colocynthin is decomposed according to Walz by boiling dilute hydrochloric acid, and then yields *Colocynthein*, $C^{44}H^{64}O^{13}$, and grape sugar.

The same chemist termed *Colocynthitin* that part of the alcoholic extract of colocynth which is soluble in ether but not in water. Purified with boiling alcohol, colocynthitin forms a tasteless crystalline powder.

The pulp perfectly freed from seeds and dried at 100° C., afforded us 11 per cent. of ash; the seeds alone yield only 2·7 per cent. They have, even when crushed, but a faint bitter taste and contain 17 per cent. of fat oil.

Commerce—The drug is imported from Mogador, Spain and Syria.

Uses—In the form of an extract made with weak alcohol, and combined with aloes and scammony, colocynth is much employed as a purgative. The seeds roasted or boiled, are the miserable food of some of the poorest tribes of the Sahara.[1]

Substitutes—*Cucumis trigonus* Roxb. (*C. Pseudo-colocynthis* Royle), a plant of the plains of Northern India, with spherical or elongated, sometimes obscurely trigonous, bitter fruits, prostrate *rooting* stems and deeply divided leaves, resembles the colocynth gourd and has been mistaken for it. Another species named by Royle *C. Hardwickii* and known to the natives of India as *Hill Colocynth*, has oval oblong bitter fruits, but leaves entirely unlike those of *Citrullus Colocynthis*.

UMBELLIFERÆ.

HERBA HYDROCOTYLES.

Indian Hydrocotyle, Indian Pennywort; F. *Bevilacqua*.

Botanical Origin—*Hydrocotyle asiatica* L., a small creeping herb,

[1] See my paper on *Cucumis Colocynthis* considered as a nutritive plant in the *Archiv der Pharmacie*, 201 (1872) 235.—F. A. F.

a slender jointed stems, common in moist places throughout tropical a and Africa, occurring also in America from South Carolina to divia, in the West Indies, the islands of the Pacific, New Zealand, . Australia.

History—The plant was known to Rheede[1] by its Malyalim name of *Tagam* (or *Kutakan*), and also to Rumphius.[2] It has been long used dicinally by the natives of Java and of the Coromandel coast. In 52, Boileau, a French physician of Mauritius, pointed out its virtues the treatment of leprosy,[3] for which disease it was largely tried in the pitals of Madras by Hunter[4] in 1855. It has since been admitted to lace in the *Pharmacopœia of India*.

Description[5]—The peduncles and petioles are fascicled; the latter frequently 2½ inches long; the peduncles are shorter and bear a 3-l-flowered simple umbel with very short rays. The leaves are reni-s, crenate, ½ to 2 inches in longest diameter, 7-nerved, glabrous, or when ng somewhat hairy on the under side. The fruit is laterally com-sed, orbicular, acute on the back; the mericarps reticulated, some-es a little hairy, with 3 to 5 curved ribs; they are devoid of vittæ. main root is an inch or two long, but roots are also thrown out by the cumbent stem.

When fresh, the herb is said to be aromatic and of a disagreeable er and pungent taste; but these qualities appear to be lost in drying.

Chemical Composition—An analysis of hydrocotyle has been made Lépine, a pharmacien of Pondicherry,[6] who found it to yield a some-at peculiar body which he called *Vellarin*, from *Vallárai*, the Tamil e of the plant, and regarded as its active principle. Vellarin, which aid to be obtainable from the dry plant to the extent of 0·8 to 1·0 cent., is an oily, non-volatile liquid with the smell and taste of fresh rocotyle, soluble in spirit of wine, ether, caustic ammonia, and tially also in hydrochloric acid. These singular properties do not ble us to rank vellarin in any well-characterised class of organic pounds.

By exhausting 3 ounces of the dried herb with rectified spirit, we not obtain anything like vellarin, but simply a green extract almost rely soluble in warm water, and containing chiefly tannic acid which duced an abundant green precipitate with salts of iron. With caustic ash, neither the herb nor its extract evolved any nauseous odour. dried plant afforded Lépine 13 per cent. of ash.

Uses—As an alterative tonic, hydrocotyle is allowed to be of some ity, but the power claimed for it by Boileau of curing leprosy is erally denied. Dorvault[7] regards it as belonging to the class of otico-acrid poisons such as hemlock, but we see no evidence to rant such an opinion. Besides being administered internally, it is etimes locally applied in the form of a poultice. Boileau says that entire plant is preferable to the leaves alone.[8]

[1] *H. Mal.* x. tab. 46.
[2] *Herb. Amboin.* v. 169.
[3] Bouton, *Med. Plants of Mauritius*, 73. 83.
[4] *Medical Reports*, Madras, 1855. 356.
[5] Drawn up from Indian specimens.
[6] *Journ. de Pharm.* xxviii. (1855) 47.
[7] *L'Officine* (1872) 554.
[8] It is probably by oversight that the *leaves alone* are ordered in the *Pharmacopœia of India*.

Substitutes (?)—*H. rotundifolia* Roxb., another species common in India, may be known from *H. asiatica* by having 10 or more flowers in an umbel and much smaller fruits. The European *H. vulgaris* L., easily distinguishable from the allied tropical species just described, by having its leaves orbicular and peltate (not reniform), is said to possess deleterious properties.

FRUCTUS CONII.

Hemlock fruits; F. *Fruits de Ciguë;* G. *Schierlingsfrucht.*

Botanical Origin—*Conium maculatum* L., an erect biennial herbaceous plant, flourishing by the sides of fields and streams, and in neglected spots of cultivated ground, throughout temperate Europe and Asia. It occurs in Asia Minor and the Mediterranean islands, and has been naturalized in North and South America. But the plant is very unevenly distributed, and in many districts is entirely wanting. It is found in most parts of Britain from Kent and Cornwall to the Orkneys.

History—The *Cicuta* of the Romans and Κώνειον of the Greeks was the plant under notice. The famous hemlock potion of the latter by which criminals were put to death, was essentially composed of the juice of this plant. The old Roman name *Cicuta* was subsequently applied to *Cicuta virosa* L., another umbelliferous plant which is altogether wanting in Greece and in Southern Europe generally, and does not contain any poisonous alkaloid.

Hemlock was used in Anglo-Saxon medicine. It is mentioned as early as the 10th century in the vocabulary of Alfric, archbishop of Canterbury, as "*Cicuta*, hemlic."[1] Its use in modern medicine is due chiefly to the recommendation of Störck of Vienna, since whose time (1760) the plant has been much employed. The extreme uncertainty and even inertness of its preparations, which had long been known to physicians and had caused its rejection by many, have been recently investigated by Harley.[2] The careful experiments of this physician show what are the real powers of the drug, and by what method its active properties may be utilized.

Description—The fruit has the structure usual to the order; it is broadly ovoid, somewhat compressed laterally, and constricted towards the commissure, attenuated towards the apex, which is crowned with a depressed stylopodium. As met with in the shops, it consists of the separated mericarps which are about $\frac{1}{8}$ of an inch long. The dorsal surface of these has 5 prominent longitudinal ridges, the edges of which are marked with little protuberances giving them a jagged or crenate outline, which is most conspicuous before the fruits are fully ripe. The furrows are glabrous but slightly wrinkled longitudinally; they are devoid of vittæ. When a mericarp is cut transversely, the seed exhibits a reniform outline, due to a deep furrow in the albumen on the side of the commissure.

The fruits of hemlock are dull greenish grey, and have but little taste and smell; but when triturated with a solution of caustic alkali they evolve a strong and offensive odour.

Microscopic Structure—Hemlock fruits differ from other fruits

[1] *Volume of Vocabularies*, edited by Wright, 1857. 31.

[2] *Pharm. Journ.* viii. (1867), ix. (1868).

the order by the absence of vittæ. In the endocarp, there is a culiar layer of small nearly cubic cells surrounding the albumen. The lls of the endocarp are loaded with a brown liquid consisting chiefly of mine and essential oil.

Chemical Composition—The most important constituent of the uits of hemlock is *Conine* or *Conia*, $C^8H^{15}N$, a limpid colourless oily uid, of sp. gr. 0·88, having poisonous properties; it has a strong alkaline action, and boils without decomposition at 163°·5 C. It was first served by Giseke in 1827, recognized as an alkaloid by Geiger in 1831, d more amply studied by Wertheim in 1856 and 1862. In the plant, is combined with an acid (malic?), and accompanied by ammonia as ell as by a second less poisonous crystallizable base called *Conhydrine*, $^8H^{17}NO$, which may be converted into conine by abstraction of the ements of water. From these alkaloids a liquid, non-poisonous, hydro-rbon, *Conylene*, C^8H^{14}, has been separated by Wertheim. Even in ture one hydrogen atom of conine is frequently replaced by methyl, H^3; and commercial conine commonly contains, as shown by A. von anta and Kekulé, methyl-conine $N\left\{\begin{matrix}C^8H^{14}\\CH^3.\end{matrix}\right.$ Lastly there is present hemlock fruits, a third alkaloid having probably the composition $H^{13}N$.

As to the yield of conine, it varies according to the development of e fruits, but is at best only about ⅘ per cent. According to Schroff 870), the fruits are most active just before maturity, provided they are thered from the biennial plant. At a later stage, conine is probably rtly transformed into conhydrine, which however is present in but ry small proportion,—about 1¼ per mille at most.

In its deleterious action, conine resembles nicotine, but is much less werful.

Schiff (1871–1872) has artificially produced an alkaloid partaking of e general properties of conine, and having the same composition; t it is optically indifferent. Conine on the other hand, we find turns e plane of polarization from 47°·7 to 61°·4, that is to say 13°·7 to the ght, when examined in a column 25 mm. long.[1]

The fruits of hemlock contain also a volatile oil which appears devoid poisonous properties; it exists in but small quantity and has not yet en fully examined.

Uses—The fruits of hemlock are the only convenient source of the aloid conine. They were introduced into British medicine in 1864, as a bstitute for the dried leaf in making the tincture. But it has been own that a tincture, whether of leaf or fruit, is a preparation of very all value, and that it is far inferior to the preserved juice of the rb. It has however been pointed out by W. Manlius Smith[2] and observations have been confirmed by Harley,[3] that the *green unripe its* possess more than any other part the peculiar energies of the nt, and that they may even be dried without loss of activity. A dicinal fluid extract of considerable power has been made from them Squibb of New York.

The conine thus examined had been ared by Merck, of Darmstadt, and was urless.

[2] *Trans. of the New York State Medical Society* for 1867.

[3] *The Old Vegetable Neurotics*, Lond. 1869. 94.

FOLIA CONII.

Hemlock Leaves; F. Feuilles de Ciguë; G. Schierlingsblätter.

Botanical Origin—*Conium maculatum* L., see p. 266.

History—See p. 266.

Description—Hemlock in its first year produces only a tuft of leaves, but in its second a stout erect stem which often grows to the height of 5 or 6 feet, is much branched in its upper part, and terminates in small umbels, each having about 12 rays. The lower leaves, often a foot in length, have a triangular outline, and a hollow stalk as long as the lamina, clasping the stem at its base with a membranous sheath. Towards the upper portion of the plant, the leaves have shorter stalks, are less divided, and are opposite or in cohorts of 3 to 5. The involucral bracts are lanceolate, reflexed, and about $\frac{1}{4}$ of an inch long. Those of the partial umbel are turned towards the outside, and are always 3 in number. The larger leaves are twice or thrice pinnate, the ultimate segments being ovate-oblong, acute, and deeply incised.

The stem is cylindrical and hollow, of a glaucous green, generally marked on its lower part with reddish-brown spots. The leaves are of a dull dark green, and like the rest of the plant quite glabrous. They have when bruised a disagreeable fœtid smell.

For medicinal purposes the plant should be taken when in full blossom.[1]

Chemical Composition—The leaves of hemlock contain, though in exceedingly small proportion, the same alkaloids as the fruits. Geiger obtained from the fresh herb not so much as one ten-thousandth part of conine. It is probable however that the active constituents vary in proportion considerably, and that a dry and sunny climate promotes their development.

The same observer as well as Pereira, has pointed out that hemlock leaves when dried are very frequently almost devoid of conine, and this observation is supported by the more recent experiments of Harley (1867). It has also been shown by the last-named physician, that the inspissated juice known in pharmacy as *Extractum Conii* usually contains but a mere trace of alkaloid, the latter having in fact been dissipated by the heat employed in reducing the juice to the required consistence. On the other hand, Harley has proved that the juice of fresh hemlock preserved by the addition of spirit of wine, as in the *Succus Conii* of the Pharmacopœia, possesses in an eminent degree the poisonous properties of the plant.

The entire amount of nitrogen in dried hemlock leaves was estimated by Wrightson (1845) at 6·8 per cent.; the ash at 12·8 per cent. The latter consists mainly of salts of potassium, sodium, and calcium, especially of sodium chloride and calcium phosphate.

A ferment-oil may be obtained from *Conium*; it is stated to have an odour unlike that of the plant and a burning taste, and not to be poisonous.[2]

[1] The London herbalists often collect it while much of the inflorescence is still in bud, in which state it affords far more of leaf than when well matured; but it is in the latter condition that the plant is to be preferred.

[2] Gmelin, *Chemistry*, xiv. 405.

Uses—Hemlock administered in the form of *Succus Conii*, has a ular sedative action on the motor nerves, on account of which it is asionally prescribed. It was formerly much more employed than at sent, although the preparations used were so defective that they could rely have produced the specific action of the medicine.

Plants liable to be confounded with Hemlock—Several common ants of the order *Umbelliferæ* have a superficial resemblance to *Conium*, at can be discriminated by characters easy of observation. One of these *Æthusa Cynapium* L. or *Fool's Parsley*, a common annual garden weed, much smaller stature than hemlock. It may be known by its primary mbel having no involucre, and by its partial umbel having an involucel 2 or 3 linear pendulous bracts. The ridges of its fruit moreover are t wavy or crenate as in hemlock, nor is its stem spotted.

Chærophyllum Anthriscus L. (*Anthriscus vulgaris* Pers.) and two or ree other species of *Chærophyllum* have the lower leaves not unlike ose of hemlock, but they are *pubescent* or *ciliated*. The fruits too are ear-oblong, and thus very dissimilar from those of *Conium*.

The latter plant is in fact clearly distinguished by its smooth spotted em, the character of its involucral bracts and fruit, and finally by the rcumstance that when triturated with a few drops of solution of caustic kali, it evolves conine (and ammonia), easily observable as a white me when a rod moistened with strong acetic acid is held over the ortar.

FRUCTUS AJOWAN.

Semen Ajava vel Ajowain ; Ajowan, True Bishop's weed.

Botanical Origin—*Ammi Copticum* L. (*Ptychotis Coptica* et *Pt. jowan* DC.)—an erect annual herb, cultivated in Egypt and Persia, d especially in India where it is well known as *Ajrán* or *Omam*.

History—The minute spicy fruits of the above-named plant have en used in India from a remote period, as we may infer from their ing mentioned in Sanskrit writings, such as the Ayurvedas of Susruta.

Owing to their having been confounded with some other very small mbelliferous fruits, it is difficult to trace them precisely in many of the der writers on materia medica. It is however probable that they are e *Ammi odore origani* of Anguillara (1549) and the *Ammi perpusillum* Lobel (1571), in whose time the drug was imported from Egypt. ale[1] who says it is brought from Alexandria, reports it as very scarce the London shops. Under the name of *Ajava Seeds*, the drug was ain brought into notice in 1773 by Percival,[2] who received a small antity of it from Malabar as a remedy for cholic; and still more cently, it has been favourably spoken of by Fleming, Ainslie, Roxburgh, Shaughnessy, Waring and other writers who have treated of Indian ateria medica.

Description—Ajowan fruits, like those of other cultivated *Umbelliferæ*, vary somewhat in size and form. The largest kind much resemble ose of parsley, being of about the same shape and weight. The length the large fruits is about $\frac{1}{10}$, of the smaller form scarcely $\frac{1}{18}$ of an inch.

[1] *Pharmacologia*, 1693 211.

[2] *Essays, medical and experimental*, ii. (1773) 226.

The fruits are greyish brown, plump, very rough on the surface, owing to numerous minute tubercles (*fructus muriculatus*). Each mericarp has five prominent ridges, the intervening channels being dark brown, with a single vitta in each. The commissural side bears two vittæ. The fruits when rubbed exhale a strong odour of thyme (*Thymus vulgaris* L.), and have a biting aromatic taste.

Microscopic Structure—The oil-ducts of ajowan are very large, often attaining a diameter of 200 mkm. The ridges contain numerous spiral vessels; the blunt tubercles of the epidermis are of the same structure as those in anise, but comparatively larger and not pointed. The tissue of the albumen exhibits numerous crystalloid granules of albuminous matter (aleuron), distinctly observable in polarized light.

Chemical Composition—The fruits according to Stenhouse (1855) yield 5 to 6 per cent.[1] of an agreeably aromatic, volatile oil, sp. gr. 0·896. At the same time there collects on the surface of the distilled water, a crystalline substance, which is prepared at Oojein and elsewhere in Central India, by exposing the oil to spontaneous evaporation at a low temperature. This stearoptene, sold in the shops of Poona and other places of the Deccan, under the name of *Ajwain-ka-phul*, i.e. *flowers of ajwain*, was first made known by Stocks, and was examined by Stenhouse and by Haines, who showed its identity with *Thymol*, $C^{10}H^{14}O$.

We obtained it by exposing oil of our own distillation, first rectified from chloride of calcium, to a temperature of 0° C., when the oil deposited 36 per cent. of thymol in superb tabular crystals, an inch or more in length. The liquid portion even after long exposure to a cold some degrees below the freezing point, yielded no further crop. We found the thymol thus obtained, began to melt at 44° C., yet using somewhat larger quantities, it appeared to require fully 51° C. for complete fusion. On cooling, it continues fluid for a long time, and only recrystallizes when a crystal of thymol is projected into it.

Thymol may be distilled in a current of carbonic acid; it has a sp. gr. of 1·028, and the odour of oil of ajowan. Its identity with the *Thymol* of thyme was at one time doubtful, Stenhouse having stated that the alcoholic solution of the former is precipitated by water, and that it is not soluble in caustic alkalis. But H. Müller[3] has recently showed, that thymol from either source is soluble in caustic alkalis; he has even extracted it by this means from the oil of ajowan.

The liquid part of the essential oil, which according to Stenhouse boils at 172° C., may be separated by rectification from the stearoptene which, as it commences to boil only at 218° C., remains in the still as a crystalline mass. The liquid oil according to the same chemist is isomeric with oil of turpentine and has a different odour to the stearoptene. Haines (1856) regards this oil as *Cymol* (cymene) $C^{10}H^{14}$, which also occurs in cumin, *Cicuta virosa* and in *Thymus vulgaris*. Müller has proved the correctness of this statement; he obtained a compound of it with sulphuric acid. Some hydrocarbon of the formula $C^{20}H^{32}$ may nevertheless be also present.

[1] In a small experiment made with an old sample of the drug, I got 3·12 per cent. of essential oil.—D. H.

[2] The fruits examined by Stenhouse were of the *small variety* before alluded to, as I know by an authentic specimen.—F. A. F.

[3] *Berichte d. Deutschen Chemischen Gesellschaft*, ii. (1869) 130; also *Jahresbericht* of Wiggers and Husemann, 1869. 56.

'e found that neither the thymol, nor the liquid part of ajowan
:s any rotatory power.

-Ajowan is much used by the natives of India as a condi-
ıe distilled water which has been introduced into the *Pharma-*
India, is reputed to be carminative and a good vehicle for
nedicines. It has a powerful burning taste and would seem
dilution. The volatile oil may be used in the place of oil of
ich it closely resembles.

tutes—Under the name *Semen Ammi*, the very small fruits of
ıs L. and of *Sison Amomum* L. have been often confounded with
mmi Copticum L.; but the *absence of minute tubercles* on the
r, not to mention some other differences, is sufficient to
ıy supposition of identity.
ds of *Hyoscyamus niger* L. being called in India *Khorásáni-*
onfusion might arise between them and true ajowan; though
ıt examination would suffice to show the difference.[3]

FRUCTUS CARUI.

ırui vel Carvi; Caraway Fruits, Caraway Seeds, Caraways;
F. *Fruits ou Semences de Carvi*; G. *Kümmel.*

.cal Origin—*Carum Carvi* L., an erect annual or biennial
ınlike a carrot, growing in meadows and moist grassy land
rthern and midland parts of Europe and Asia, but to what
y wild cannot be always ascertained.
ıuch cultivated in Iceland and is also apparently wild.[3] It
ıghout Scandinavia, in Finland, Arctic, Central and Southern
l in Siberia. It appears as a wild plant in many parts of
ncolnshire and Yorkshire), but is also cultivated in fields, and
: strictly indigenous. The caraway is found throughout the
t of France, in the Pyrenees, Spain, Central Europe, Armenia
ucasian provinces; and it grows wild largely in the high alpine
ahul in the Western Himalaya.[4]
most curious fact in the distribution of *Carum Carvi*, is its
in Morocco, where it is largely cultivated about El Araiche,
the city of Morocco.[5] The plant differs somewhat from that
it is an annual with a single erect stem, 4 feet high. Its
ıore divided, and its flowers larger, with shorter styles and on
ling umbels than the common caraway, and its fruit is more

y—The opinion that this plant is the Κάρος of Dioscorides
s Pliny states, it derived its name from Caria (where it has
met with in modern times) has very reasonably been doubted.[7]
y fruits were known to the Arabians, who called them

, *Flor. Ind.* ii. (1832) 91.
mistake may probably be re-
tement of Irvine (*Account of*
of Patna, 1848, p. 6) that the
ıne are "used in food as car-
ıtimulant"!
in *Journ. of Linn. Soc.*, Bot.,

[4] Aitchison in *Journ. of Linn. Soc.*, Bot., x. (1869) 76. 94.

[5] Leared in *Pharm. Journ.*, Feb. 8, 1873. 603.

[6] I have cultivated the Morocco plant during two years by the side of the common form.—D. H.

[7] Dierbach, *Flora Apicians*, 1831. 53.

Karawya, a name they still bear in the East, and the original of our words *caraway* and *carui*, as well as of the Spanish *alcarahueya*. In the Arab writings quoted by Ibn Baytar,[1] himself a Mauro-Spaniard of the 13th century, caraway is compared to cumin and anise. The spice probably came into use about this period. It is not noticed by St. Isidore, archbishop of Seville in the 7th century, though he mentions fennel, dill, coriander, anise, and parsley; nor is it named by St. Hildegard in Germany in the 12th century. Neither have we found any reference to it in the Anglo-Saxon *Herbarium of Apuleius*, written *circa* A.D. 1050,[2] or in other works of the same period, though cumin, anise, fennel, and dill are all mentioned.

On the other hand, in two German medicine-books of the 12th and 13th centuries[3] there occurs the word *Cumich*, which is still the popular name of caraway in Southern Germany; and *Cumin* is also mentioned. Caraway was certainly in use in England at the close of the 14th century, as it figures with coriander, pepper and garlick in the *Form of Cury*, a roll of ancient English cookery compiled by the master-cooks of Richard II. about A.D. 1390.

The oriental names of caraway show that as a spice it is not a production of the East:—thus we find it termed *Roman* (i.e. *European*), *Armenian, mountain*, or *foreign Cumin*; *Persian* or *Andalusian Caraway*; or *foreign Anise*. And though it is now sold in the Indian bazaars, its name does not occur in the earlier lists of Indian spices.

Cultivation[4]—In England, the caraway is cultivated exclusively in Kent and Essex, on clay lands. It was formerly sown mixed with coriander and teazel seed, but now with the former only. The plant, which requires the most diligent and careful cultivation, yields in its second year a crop which is ready for harvesting in the beginning of July. It is cut with a hook at about a foot from the ground, and a few days afterwards may be thrashed. The produce is very variable, but may be stated at 4 to 8 cwt. per acre.

Description—The fruits which in structure correspond to those of other plants of the order, are laterally compressed and ovate. The mericarps which hang loosely suspended from the arms of the carpophore are in the English drug about $\frac{1}{6}$ of an inch in length and $\frac{1}{20}$ in diameter, subcylindrical, slightly arched, and tipped with the conical, shrivelled stylopodium. They are marked with 5 pale ridges, nearly half as broad as the shining, dark brown furrows, each of which is furnished with a conspicuous vitta; a pair of vittæ separated from each other by a comparatively thin fibro-vascular bundle, occurs on the commissure.

Caraways are somewhat horny and translucent; when bruised they evolve an agreeable fragrance resembling that of dill, and they have a pleasant spicy taste. In the London market, they are distinguished as *English, Dutch, German*, and *Mogador*, the first sort fetching the highest price. The fruit varies in size, tint and flavour; the English is shortest and plumper than the others; the Mogador is paler, stalky and elongated,—often $\frac{3}{16}$ of an inch in length.

[1] Sontheimer's translation, ii. 368.

[2] *Leechdoms, &c. of Early England*, i. (1864).

[3] Pfeiffer, *Zwei deutsche Arzneibücher aus dem xii. und xiii. Jahrhundert*, Wien 1863, 14.

[4] Morton, *Cyclop. of Agriculture*, i. (1858) 390.

scopic Structure—Caraways are especially distinguished by mous vittæ, which in transverse section display a triangular e largest diameter, *i.e.* the base of the triangle, often attaining s 300 mkm. Even those of the commissure are usually not

ical Composition—Caraways contain a volatile oil, which n drug affords to the extent of about 4 per cent., though vari- m 3 to 6, or even exceptionally to 9 per cent., have been It appears that a northerly or elevated locality tends to plant more productive in essential oil. The position and e vittæ account for the fact that comminution of the fruits distillation, does not increase the yield of oil.

caraway according to the experiments of Schweizer and of s a mixture of *Carvol*, $C^{10}H^{14}O$, a mobile liquid boiling at ladstone), and *Carvene*, which latter constitutes more than a e crude oil. Carvene boils at 173° C., and has the formula has been ascertained by us that each of these constituents has rate power, that of carvene being considerably the stronger. someric according to Gladstone,[2] with the menthol of spearmint, and the carvol of dill; with the last it is probably identical. someric with thymol, but does not like that body unite with t easily forms large acicular crystals, $2(C^{10}H^{14}O) + H^2S$, when h alcoholic sulphide of ammonium.

caraway of inferior quality is obtained from the refuse of the find it less dextrogyrate than the oil from the fruits alone. r is of less agreeable odour, but is good enough to be used for ng of soap. The oil distilled in England from home-grown s preferred in this country. On the Continent, that extracted araways of Halle and of Holland, is considered to be of finer n the oil obtained from those of Southern Germany.

mature fruit of caraway is rich in tannic matter, striking blue of iron. It occurs abundantly in the tissue around the oil- re the presence of sugar may be also detected by alkaline copper. Sugar occurs likewise in the embryo, but not in the n which latter protein substances predominate.

ction and Commerce—Caraways are exported from Fin- most northerly province of Norway; from Finland and Russia. ny, the cultivation, recommended by Gleditsch in 1776, is y carried on in Moravia, and in Prussia, especially in the neigh- f Halle. The districts of Erfurt and Merseburg, also in Prussia, to yield annually about 30,000 cwt. Dutch caraways are pro- he provinces of North Holland, Gelderland and North Brabant, er two from wild plants.[3] Caraways are frequently shipped ports of Morocco; the quantity exported thence in 1872 was

port of caraways into the United Kingdom in 1870, amounted cwt., almost all being from Holland.

Chemistry xiv. (1860) 416. 414.

Chem. Soc. x. (1872) 9; *Pharm.* h 1872. 746.

[3] Oudemans, *Aanteekeningen, &c.*, Rotterdam, 1854-1856. 351.

[4] *Consular Reports*, August 1873. 917.

The essential oil is manufactured on a large scale. According to a statement of the Chamber of Commerce of Leipzig,[1] four establishments of that district produced in 1872, no less a quantity than 30,955 kilo. (68,277 lb.), valued at £24,000.

Uses—Caraway in the form of essential oil or distilled water is used in medicine as an aromatic stimulant, or as a flavouring ingredient. But the consumption in Europe is far more important as a spice, in bread, cakes, cheese, pastry, confectionary, sauces, &c., or in the form of oil as an ingredient of alcoholic liquors. The oil is also used in perfumery.

FRUCTUS FŒNICULI.

Fennel Fruits, Fennel Seeds ; F. *Fruits de Fenouil ;* G. *Fenchel.*

Botanical Origin—*Fœniculum vulgare* Gärtn. (*Anethum Fœniculum* L.), an erect, branching plant with an herbaceous stem and perennial rootstock, growing to the height of 3 or 4 feet, having leaves 3 or 4 times pinnate with narrow linear segments.

It appears to be truly indigenous to the countries bordering the Mediterranean, but is also found apparently wild, over a large portion of Western Europe as far as the British Isles, especially in the vicinity of the sea. It grows in the country bordering the western side of the Caspian Sea, and as a doubtful native in many parts of Central and Southern Russia.

Fennel is largely cultivated in the central parts of Europe, as Saxony, Franconia and Wurtemberg, also in the south of France about Nîmes, and in Italy. It is extensively grown in India and China. The Indian plant is an annual of somewhat low stature.[2]

The plant varies in stature, foliage, and in the size and form of its fruits; but all the forms belong apparently to a single species.

History—Fennel was used by the ancient Romans, as well for its seedlike aromatic fruits, as for its edible succulent shoots. It was also employed in Northern Europe at a remote period, as it is constantly mentioned in the Anglo-Saxon medical receipts, which date as early at least as the 11th century. The diffusion of the plant in Central Europe was stimulated by Charlemagne, who enjoined its cultivation on the imperial farms. Fennel shoots (*turiones fœnuculi*), fennel water, and fennel seed, as well as anise, are all mentioned in an ancient record[3] of Spanish agriculture, dating A.D. 961.

Description—The fennel fruits of commerce, commonly called *Fennel Seeds*, are of several kinds and of very different pecuniary value. The following are the principal sorts:—

1. *Sweet Fennel*,—known also as *Roman Fennel*, is cultivated in the neighbourhood of Nîmes in the south of France. The plant is a tall perennial with large umbels of 25 to 30 rays.[4] As the plants grow old the fruits of each succeeding season gradually change in shape and diminish in size, till at the end of 4 or 5 years they are hardly to be

[1] *Pharmaceutische Zeitung*, 15 April, 1874.

[2] It is an annual even in England, ripening seeds in its first year, and then dying.

[3] *Le Calendrier de Cordoue de l'année* 961, publié par R. Dozy, Leyde, 1873.

[4] The Nîmes fennel has been usually referred to *Fœniculum dulce* DC., but the plant has the stem compressed at the base and only 6 to 8 rays in the umbel: and is the fennel which is eaten as a vegetable or in a salad.

nguished from those of the wild fennel growing in the same district. curious fact, remarked by Tabernæmontanus (1588), was experi- ally proved by Guibourt.[1]

he fruits of Sweet Fennel as found in the shops, are oblong, drical, about $\frac{4}{10}$ of an inch in length by $\frac{1}{10}$ in diameter, more or less d, terminating with the two-pointed base of the style, and smooth e surface. Each mericarp is marked by 5 prominent ridges, the l being thicker than the dorsal. Between the ridges lie vittæ, here are two vittæ on the commissural surface,—all filled with dark natter. The fruits seen in bulk have a pale greenish hue; their r is aromatic, and they have a pleasant, saccharine, spicy taste.

German Fennel, Saxon Fennel, produced especially near Weissenfels e Prussian province of Saxony; the fruits are $\frac{3}{10}$ to $\frac{1}{4}$ of an inch ovoid-oblong, a little compressed laterally, slightly curved, ter- ting in a short conical stylopodium; they are glabrous, of a deep n, each mericarp marked with 5 conspicuous pale ridges, of which ateral are the largest. Seen in bulk, the fruits have a greenish n hue; they have an aromatic saccharine taste, with the peculiar of fennel.

Wild or Bitter Fennel (*Fenouil amer*), collected in the south of e, where the plant grows without cultivation. They are smaller roader than those of the German Fennel, being from $\frac{1}{4}$ to $\frac{1}{3}$ of an long by about $\frac{1}{12}$ of an inch wide. They have less prominent ridges t maturity are a little scurfy in the furrows and on the commissure. taste is bitterish, spicy, and strongly fennel-like. The essential *essence de Fenouil amer*) is distilled from the entire herb.

Indian Fennel.—A sample in our possession from Bombay bles Sweet Fennel, but the fruits are not so long, and are usually ht. The mother-plant of this drug is *F. Panmorium* DC., now led as a simple variety of *F. vulgare* Gärtn.

Microscopic Structure—The most marked peculiarity of fennel is ited by the vittæ, which are surrounded by a brown tissue. The is made up of cells resembling the usual form of cork-cells. In Fennel the vittæ are smaller than in the German fruit; in the verse section of the latter, the largest diameter of these ducts is about 1km.

hemical Composition—The most important constituent of l fruits is the volatile oil, which is afforded both by the Sweet and erman fennel to the extent of about $3\frac{1}{2}$ per cent.

l of fennel from whatever variety of the drug obtained, consists of *ol* or *Anise-camphor*, $C^{10}H^{12}O$, and variable proportions of a liquid, ric with oil of turpentine. Anethol is obtainable from fennel in rms, the solid and the liquid; crystals of the former are deposited the oil is subjected to a somewhat low temperature; the liquid ol may be got by collecting the portion of the crude oil passing over 5° C. The crystals of anethol fuse between 16 and 20° C.; the form of anethol remains fluid even at − 10° C. By long keeping, ystals slowly become liquid and lose their power of reassuming a lline form. Three varieties of oil of fennel are found in commerce, y the oils of *Sweet Fennel* and *Bitter Fennel* offered by the drug-

[1] *Hist. des Drogues*, iii. (1869) 233.

houses of the south of France; their money value is as 3 to 1, the oil of sweet fennel, which has a decidedly *sweet* taste, being by far the most esteemed. The third variety is obtained from Saxon fennel, especially by the manufacturers of Dresden and Leipzig.[1] We have been supplied with type-specimens of the first two oils by the distillers, Messrs. J. Sagnier, fils, & Cie., Nîmes; a specimen of the third has been distilled in the laboratory of one of ourselves.

Oil of fennel differs from that of anise by displaying a considerable rotatory power. We found the above-mentioned specimens, examined in a column 50 mm. long, to deviate the ray of polarized light to the right thus:—

Oil of Sweet Fennel	29°·8
,, Bitter ,,	4°·8
,, German ,,	9°·1

The rotatory power is due to the hydrocarbon contained in the oil; we ascertained that anethol from oil of anise is devoid of it.

Fennel fruits contain sugar, yet their sweetness or bitterness depends on the essential oil rather than on the presence of that body. The albumen of the seed contains fixed oil, which amounts to about 12 per cent. of the fruit.

Uses—Fennel fruits are used in medicine in the form of distilled water and volatile oil, but to no considerable extent. The chief consumption is in cattle medicines, and of the oil in the manufacture of cordials.

FRUCTUS ANISI.

Anise, Aniseed; F. *Fruits d'Anis vert;* G. *Anis.*

Botanical Origin—*Pimpinella Anisum* L., an annual plant, indigenous to Asia Minor, the Greek Islands and Egypt, now cultivated in many parts of Europe where the summer is hot enough for ripening its fruits, as well as in India and South America. It is not grown in Britain.

History—Anise, which the ancients obtained chiefly from Crete and Egypt, is among the oldest of medicines and spices.[2] It is mentioned by Theophrastus, and by the later writers Dioscorides and Pliny. In Europe we find that Charlemagne (A.D. 812) commanded that anise should be cultivated on the imperial farms in Germany. The Anglo-Saxon writings contain frequent allusions to the use of dill and cumin, but we have failed to find in them any reference to anise.

The Patent of Pontage granted by Edward I. in 1305 to raise funds for repairing the Bridge of London,[3] enumerates *Anise* (*anisium*) among the commodities liable to toll. There are entries for it under the name of *Annis vert*, in the account of the expenses of John, king of France, during his abode in England, 1359–60[4]; and it is one of the spices of which the Grocers' Company of London had the weighing and oversight

[1] The Leipzig Chamber of Commerce reports the quantity made by four establishments in 1872, as 4350 kilo. (9594 lb.).

[2] On the *Anise* of the Bible, see note 1, p. 292.

[3] [Thomson, R.], *Chronicles of London Bridge*, 1827. 155.

[4] Douët d'Arcq, *Comptes de l'Argenterie des Rois de France*, 1851. 206. 220.

m 1453.[1] By the *Wardrobe Accounts* of Edward IV., A.D. 1480,[2] it pears that the royal linen was perfumed by means of "lytill bagges fustian stuffed with ireos and *anneys*."

Anise seems to have been grown in England as a potherb prior to 12, for Boorde in his *Dyetary of Helth*, printed in that year,[3] says of nd fennel,—"these herbes be seldome vsed, but theyr seedes be greatly upyde."

In common with all other foreign commodities, anise was enormously ed during the reign of Charles I., the duties levied upon it amounting 75s. per 112 lb.[4]

Description—Anise fruits which have the usual characters of the ler, are about $\frac{2}{10}$ of an inch in length, mostly undivided and attached a slender pedicel. They are of ovoid form, tapering towards the nmit which is crowned by a pair of short styles, rising from a thick lopode; they are nearly cylindrical but a little constricted towards the nmissure. Each fruit is marked by 10 light-coloured ridges which e it a prismatic form; these as well as the rest of the surface of the it, are clothed with short rough hairs. The drug has a greyish brown e, a spicy saccharine taste, and an agreeable aromatic smell.

Microscopic Structure—The most striking peculiarity of anise it is the large number of oil-ducts or vittæ it contains; each half of e fruit exhibits in transverse section, nearly 30 oil-ducts, of which the to 6 in the commissure are by far the largest. The hairs display simple structure, inasmuch as they are the elongated cells of the idermis a little rounded at the end.

Chemical Composition—The only important constituent of anise the essential oil (*Oleum Anisi*), which the fruits afford to the extent of arly 2 per cent.[5] This oil is a colourless liquid, having an agreeable our of anise and a sweetish aromatic taste; its sp. gr. varies from 77 to 0·983. At 10° C. to 15° C., it solidifies to a hard crystalline ss, which does not resume its fluidity till the temperature rises to out 17° C.

Oil of anise resembles the oils of fennel, star-anise, and tarragon, in it it consists almost wholly of *Anethol* or *Anise-camphor*, described in previous article (p. 275). This fact explains the rotatory power of oil of se being inferior to that of fennel. Oil of German anise, distilled by e of us, examined under the conditions stated on the opposite page, iated only 1°·7, but to the left. *Franck* (1868) found oil of Saxon se deviating 1°·1 to the right.

Production and Commerce—Anise is produced in Malta, about cante in Spain, in Touraine and Guienne in France, in Puglia (Southern ly), in several parts of Northern and Central Germany, Bohemia and ravia. The Russian provinces of Tula and Orel, south of Moscow, produce excellent anise, and in Southern Russia, Charkow is likewise wn for the production of this drug. In Greece, anise is largely

Herbert, *Hist. of the twelve Great Livery panies of London*, 1834. 310.

Edited by N. H. Nicolas, Lond. 1830.

Reprinted for the Early English Text ty, 1870. 281.

[4] *Rates of Marchandizes*, 1635.

[5] Thus 5126 lb. of aniseed distilled in the course of three years in the laboratory of Messrs. Herrings of London, afforded 95 lb. 5 oz. of essential oil, equal to 1·85 per cent.

cultivated under the name of γλυκάνισον, and it is much grown Northern India. Considerable quantities are also now imported f Chili.

Uses—Anise is an aromatic stimulant and carminative, usu administered in the form of essential oil as an adjunct to other medic It is also used as a cattle medicine. The essential oil is largely consu in the manufacture of cordials, chiefly in France, Spain, Italy, and S America.

Adulteration—The fruits of anise are sometimes mixed with f of hemlock, but whether by design or by carelessness we know Careful inspection with a lens will reveal this dangerous adulter We have known *powdered* anise also to contain hemlock, and detected it by trituration in a mortar with a few drops of soluti potash, a sample of pure anise for comparison being tried at the time.

The essential oil of aniseed may readily be confounded with th Star-anise, which is distilled from the fruits of the widely dif *Illicium anisatum*. As stated at p. 22, these oils agree so closely in chemical and optical properties, that no scientific means are know distinguishing them.

RADIX SUMBUL.

Sumbul Root; F. *Racine de Sumbul, Sambola ou Sambula*; G. *Mos wurzel.*

Botanical Origin—*Euryangium Sumbul* Kauffmann,[1] a tall p nial plant closely resembling a *Ferula*, discovered in 1869, by a Ru traveller, Fedschenko, in the mountains of Maghian[2] near Pianjak small Russian town, eastward of Samarkand. A living plant transp thence to the Botanical Garden of Moscow flowered there in 1871.

History—The word *sumbul*, which is Arabic and signifies *an spike*, is used as the designation of various substances, but especia *Indian Nard*, the rhizome of *Nardostachys Jatamansi* DC. Under circumstances, or at what period, it came to be applied to the drug notice, we know not. Nor are we better informed as to the hist sumbul root, which we have been unable to trace by means of the works at our disposal. All we can say is, that the drug wa introduced into Russia about the year 1835 as a substitute for musk it was then recommended as a remedy for cholera, and that it be be known in Germany in 1840, and ten years afterwards in En It was admitted into the *British Pharmacopœia* in 1867.

Description—The root as found in commerce, consists of tran slices, 1 to 2 inches, rarely as much as 5 inches in diameter, and a or more in thickness; the bristly crown, and tapering lower po

[1] *Nouv. Mém. de la Soc. imp. des Nat. de Moscou*, xii. (1871) 253. tabb. 24. 25.

[2] Maghian or Magian is a town situated on a river of the same name, rising on the northern side of the Shehri Sebztan range of mountains, lying S.E of Samarkand. The Maghian flowing north, falls into the Zaraf-shan about 40 miles eastward of Sam Pianjakent or Pentschakend, 3393 fe the sea, is on the left bank of the Zar little to the west of the point at wh river is joined by the Maghian. For particulars, see *Journ. of R. Geogr* xl. (1870) 448.

ıicker than a quill, are also met with. The outside is covered papery bark; the inner surface of the slices is of a dirty brown, ·ith white, showing when viewed with a lens an abundant :udation, especially towards the circumference. The interior y, fibrous, farinaceous-looking substance, having a pleasant ›ur and a bitter aromatic taste.

: not acquainted with the *Indian Sumbul Root* described in *'lements of Materia Medica.*[1] That imported some years since a and noticed in the same work, appears to us to be a root om sumbul.

ıcopic Structure—The interior tissue of sumbul root is very constructed of woody and medullary rays, while the cortical ›its a loose spongy parenchyme. The structural peculiarity becomes obvious, if thin slices are moistened with solution of ›n the medullary rays assume by reason of the starch they intense blue. The structure of the root reminds one by its · of rhubarb, though the latter wants the large balsam-ducts in the roots of this as well as of other *Umbelliferæ.*[2]

cal Composition—Sumbul root yields about 9 per cent. of a ic resin soluble in ether, and a very small proportion of essen- he resin has a musky smell,not fully developed until after con- ·ater. According to Reinsch (1848), it dissolves in strong ıcid with a fine blue colour, but in our experience with a ›wn. The same chemist states that when subjected to dry it yields a blue oil.

ı of potash is stated to convert the resin of sumbul into a potassium salt of *Sumbulamic Acid*, which latter was obtained alline state by Reinsch in 1843, but has not been further Sumbulamic acid, which smells strongly of musk, appears to nt substance from *Sumbulic* or *Sumbulolic Acid*, the potassium ch may be extracted by water from the above-mentioned ution. Ricker and Reinsch (1848) assert that the last-men- of which the root contains about $\frac{3}{4}$ per cent., is none other *ic Acid*, accompanied as in angelica root, by a little valerianic :hese substances require further investigation, as well as the *Sumbulin*, which was prepared by Murawjeff (1853), and is ı with acids, crystalline salts.

· has shown (1859) that by dry distillation, sumbul resin *'elliferone*, which substance we shall further notice when he constituituents of galbanum.

Prescribed in the form of tincture as a stimulating tonic.

850-53) 2284.

:ure and growth of Sumbul elaborately studied by Tchis- se observations first published in Russian in 1870, an Italian translation with two plates has appeared in the *Nuovo Giornale Botanico* for Oct. 1873. 298.

ASAFŒTIDA.

Gummi-resina Asafœtida vel Assafœtida; Asafœtida; F. *Asa-fœtid*
G. *Asant, Stinkasant.*

Botanical Origin—Two perennial umbelliferous plants are n generally cited as the source of this drug; but though they are b capable of affording a gum-resin of strong alliaceous odour, it has been proved that either of them furnishes the asafœtida of comme The plants in question are:—

1. *Narthex*[1] *Asa-fœtida* Falconer (*Ferula Narthex* Boiss.), a gig herbaceous plant, having a large root several inches in thickness, crown of which is clothed with coarse bristly fibres; it has an stem attaining 10 feet in height, throwing out from near its upwards a regular series of branches bearing compound umbels, branch proceeding from the axil of a large sheathing inflated pe the upper of which are destitute of lamina. The radical leaves, 1½ long, are bipinnate with broadly ligulate obtuse lobes. It has a flat fruit with winged margin. When wounded, the plant exu milky juice having a powerful smell of asafœtida. It commenc grow in early spring, rapidly throwing up its foliage which dies aw the beginning of summer. It does not flower till the root has acq a considerable size and is several years old.

N. Asa-fœtida, which now exists in several botanic gardens an flowered twice in that of Edinburgh, was discovered by Falconer in in the valley of Astor or Hasora (35° N. lat., 74°·30 E. long.) no Kashmír.[2]

2. *Scorodosma fœtidum* Bunge.—In form of leaf, in the bristly mit of the root, and in general aspect, this plant resembles the prec but it has the stem (5 to 7 feet high) nearly naked, with the umbels are very numerous, collected at the summit; and the few stem-l have not the voluminous sheathing petioles that are so striking a f in *Narthex*. In *Narthex*, the vittæ of the fruit are conspicuou *Scorodosma* almost obsolete; but the development of these orga feruloid plants varies considerably, and has been rejected by Be and Hooker as affording no important distinctive character. *Scoro* is apparently more pubescent than *Narthex*.

S. fœtidum was discovered by Lehmann in 1841, in the sandy d eastward of the Sea of Aral, and also on the hills of the Karatagh south of the river Zarafshan,—that is to say, south-east of Sama In 1858–59, it was observed by Bunge about Herat. At nearl same period, it was afresh collected between the Caspian and S Aral, and in the country lying eastward of the latter, by Borszc Russian botanist, who has made it the subject of an elaborat valuable memoir.[3]

[1] The genera *Narthex* and *Scorodosma* are held by Bentham and Hooker (*Genera Plantarum*, i. 918) as in nowise distinguishable from *Ferula*, and they have accordingly been suppressed by these botanists. Without questioning the propriety of this course, we retain for the present to ensure distinctness the designations bestowed by Falconer and by Bunge.

[2] We refrain from citing locali Tibet, Beluchistan and Persia, wher supposed to agree with that of Falco been found by other collectors.

[3] *Die Pharmaceutisch-wichtigen Fe der Aralo-Caspischen Wüste*, St. Peters pp. 40, eight plates.

lliacea Boiss.[1] (*F. Asafœtida* Boiss. et Buhse, non Linn.) dis-
.850 by Buhse, and observed in 1858–59 by Bunge in many
rsia, is said to exhale a strong odour of asafœtida and to
n Khorassan as *angúza*, the same name that is applied to
F. teterrima Kir. et Kar., a plant of Soungaria, is likewise
for its intense alliaceous smell; but neither plant is known
e of any commercial product.[2]

t detailed account of the asafœtida plant we possess, is that
an traveller Engelbert Kämpfer, who in 1687 observed it in
province of Laristan, between the river Shúr and the town
also in the neighbourhood of the town of Dusgun or Disgun,
atter locality[3] alone he saw the gum-resin collected. He
he found the plant also growing near Herat. Kämpfer has
es of his plant which he calls *Asa fœtida Disgunensis*, and
ns consisting of remnants of leaves, a couple of mericarps
tate) and a piece of the stem a few inches long, are still
the British Museum.

aterials have been the subject of much study, in order to
hich of the asafœtida plants of modern botanists should be
ith that of Kämpfer. Falconer and Borszczow have arrived
the conclusion that his own plant accords with Kämpfer's.
er's figures agree well neither with *Narthex* nor with *Scoro-*
e plant they represent does not form, it would seem, the
pyramid of the *Narthex* (as it flowered at Edinburgh),
the multitude of umbels seen in Borszczow's figure of
4

r Kämpfer's plant is really identical with either of those we
d, and whether the discrepancies observable are due to careless
to actual difference, are points that cannot be settled without
ation of more ample specimens.

llowance must be made for the period of growth at which
s have been observed. Kämpfer saw his plant when quite
l not when its stem was young and flowering. *Narthex* is
own except from specimens grown at Edinburgh, those ob-
alconer in Tibet having been gathered when dry and withered.
zow's plant appears never to have been seen by any botanist
wer-stem was in a growing state.

—Whether the substance which the ancients called *Laser*
e as the modern *Asafœtida*, is a question that has been often
uring the last three hundred years, and it is one upon which
tempt to offer no further evidence. Suffice it to say that
ntioned along with products of India and Persia, among the
which duty was levied at the Roman Custom House of Alex-
e 2nd century.

da was certainly known to the Arabian and Persian geo-
d travellers of the middle ages. One of these, Ali Istakhri, a
stakr, the ancient Persepolis, who lived in the 10th century,
it is produced abundantly in the desert between Sistan and

ntalia, ii. (1872) 995.
, *op. cit.* 13-14.
cannot find on any map.
gures his plant with about 6 umbels on a stalk, while *Scorodosma*, as represented by Borszczow, has at least 25.
[3] *Buch der Länder*, translated by Mordtmann, Hamburg, 1845. 111.

Makran, and is much used by the people as a condiment. The region i question comprises a portion of Beluchistan.

The geographer Edrisi,[1] who wrote about the middle of the 12t century, asserts that asafœtida, called in Arabic *Hiltit*, is collect largely in a district of Afghanistan near Kaleh Bust, at the junction the Helmand with the Arghundab, a locality still producing the dr Other Arabian writers as quoted by Ibn Baytar,[2] describe asafœtida terms which show it to have been well known and much valued.

Matthæus Platearius of Salerno, who flourished in the second hal the 12th century, mentions asafœtida in his work on simple medici known as *Circa instans*, which was held in great esteem during middle ages. It is also named a little later by Otho of Cremona,[3] remarks that the more fœtid the drug, the better its quality. Like o productions of the East, asafœtida found its way into European comm during the middle ages through the trading cities of Italy. It is wo of remark that it is much less frequently mentioned by the older wri than galbanum, sagapenum and opopanax.

Collection—The collecting of asafœtida on the mountains about l gun in Laristan in Persia, as described by Kämpfer,[4] is performed the

The peasants repair to the localities where the plants abound, a the middle of April, at which time the latter have ceased growing, their leaves begin to show signs of withering. The soil surrounding plant is removed to the depth of a span, so as to bare a portion o root. The leaves are then pulled off, the soil is replaced, and over i laid the leaves and other herbage, with a stone to keep them in p the whole being arranged in this way to prevent injury to the roo the heat of the sun.

About forty days later, that is towards the end of May, the p return, the men being armed with knives for cutting the root, and t iron spatulas for collecting the exuded juice. Having first remove leaves and earth, a thinnish slice is taken from the fibrous crown o root, and two days later the juice is scraped from the flat cut su The root is again sheltered, care being taken that nothing rests o This operation is repeated twice in the course of the next few da very thin slice being removed from the root after each scraping. product got during this first cutting is called *shīr*, i.e. *milk*, and is thi and more milky and less esteemed than that obtained afterwards. not sold in its natural state, but is mixed with soft earth (*terra li* which is added to the extent of an equal, or even double, weight o gum-resin, according to the softness of the latter.

After the last cutting, the roots are allowed to rest 8 or 10 when a thicker exudation called *pispaz*, more esteemed than the fir obtained by a similar process carried on at intervals during June July, or even later, until the root is quite exhausted.

The only recent account of the production of asafœtida that we met with, is that of Staff-surgeon H. W. Bellew, who witnessed collection of the drug in 1857 in the neighbourhood of Kand

[1] *Géographie d'Edrisi*, traduite par Jaubert, i. (1836) 450.

[2] *Sontheimer's transl.* i. (1840) 84.

[3] Choulant, *Macer Floridus*, Lips. 1832. 159.

[4] *Amœnitates Exoticæ*, Lemgoviæ, 535–552.

[5] *Journal of a Mission to Afgha* Lond. 1862. 270.

ithered stem of the previous year with the cluster of newly-
aves, is cut away from the top of the root, around which
of 6 inches wide and as many deep, is dug in the earth.
ep incisions are now made in the upper part of the root, and
on is repeated every 3 or 4 days as the sap continues to exude,
on for a week or two according to the strength of the plant.
collects in tears about the top of the root, or when very
lows into the hollow around it. In all cases as soon as
re made, the root is covered with a bundle of loose twigs or
ven with a heap of stones, to protect it from the drying effects
The quantity of gum-resin obtained is variable; some roots
ely half an ounce, others as much as two pounds. Some of
are no larger than a carrot, others attain the thickness of a
The drug is said to be mostly adulterated before it leaves the
y admixture of powdered gypsum or flour. The finest sort,
nerally sold pure, is obtained solely "from the node or leaf-
centre of the root-head." At Kandahar, the price of this
rug is equivalent to from 2*s.* 8*d.* to 4*s.* 8*d.* per lb., while the
rt is worth but from 1*s.* to 2*s.*

a journey from North-western India to Teheran in Persia,
luchistan and Afghanistan, performed in the spring of 1872,
raveller observed the asafœtida plant in great abundance on
he elevated undulating pasture-covered plains and hills of
n, and of the Persian province of Khorassan. He states that
of two kinds, the one called *Kamá-i-gawí* which is grazed
nd used as a potherb, and the other known as *Kamá-i-angúza*
rds the gum-resin of commerce. The collecting of this last
exclusively in the hands of the western people of the Kákarr
f the most numerous and powerful of the Afghan clans, who
occupied, spread their camps over the plains of Kandahar to
s of Herat.[1]

his journey to the source of the Oxus, found asafœtida to
produced in a district to the north of this, namely the moun-
d Saigan or Sykan (lat. 35° 10, long. 67° 40), where, says he,
ffording the plant is as regularly apportioned out and as
uarded as the cornfields on the plain.[2]

ption—The best asafœtida is that consisting chiefly of agglu-
rs. Freshly imported, it forms a clammy yet hard yellowish-
in which opaque, white or yellowish milky tears sometimes
two long, are more or less abundant. By exposure to air, it
bright pink and then a brown hue. The perfectly pure tears
en fractured a conchoidal surface, which changes from milky
rplish pink in the course of some hours If a tear is touched
acid, sp. gr. 1·2, it assumes for a short time a fine green colour.
safœtida is rubbed in a mortar with oil of vitriol, then diluted
and neutralized, the slightly coloured solution exhibits a
rescence. The tears of asafœtida when warmed become ad-
by cold are rendered so brittle that they may be powdered.
they easily form a white emulsion. The drug has a powerful
ent alliaceous odour and a bitter acrid alliaceous taste.

[1] *From the Indus to the Tigris*, 101. 102. 286. 321. &c.

[2] Wood, *Journey to the Source of the River Oxus*, new ed., 1872. 131.

Sometimes asafœtida has been imported as a fluid honey-like ma apparently pure. We presume that such is that of the first gatheri which Kämpfer says is called *milk*. The drug is often adulterated wi earthy matter which renders it very ponderous. This earthy or sto asafœtida constitutes at Bombay, a distinct article of commerce un the name of *Hingra*, the purer drug being called *Hing*.

Among the natives of Bombay, a third form of asafœtida is in that commands a much higher price than those just described, an therefore never brought into European trade.[1] It forms a dark bro *translucent*, brittle mass, of extremely fœtid alliaceous odour, contai many pieces of the stem with no admixture of earth. Guibourt by w it was first noticed[2] was convinced that it had not been obtained f the root, but had been *cut from the stem*. He remarks that Theophr alludes to asafœtida (as he terms the *Silphium*[3] of this author) as l of two kinds,—the one of the stem, the other of the root; and th the former may be the sort under notice. Vigier[4] who calls it *fœtida nauséeux*, found it to consist in 100 parts, of resin and ess oil 37·50, gum 23·75, remains of stalks 38·75. This drug appears the superior sort alluded to by Bellew.

Chemical Composition—Asafœtida consists of resin, gum essential oil, in varying proportions, but the resin generally amou to more than one half. Malic acid, so generally diffused in umbelli plants, is also present; and the watery distillate contains acetic, fo and valerianic acids.

The volatile oil amounts to between 3 and 5 per cent. It tains sulphur, and must therefore be distilled from glass vessels. light yellow, has a repulsive, very pungent odour of asafœtida, tas first mild, then irritating, but does not stimulate like oil of mu when applied to the skin. It is neutral, but after exposure to t acquires an acid reaction and different odour; it evolves sulphu hydrogen. In the fresh state, the oil is free from oxygen; it beg boil at 135° to 140° C., but with continued evolution of hydrogen sul so that even Hlasiwetz did not succeed in preparing it of constant position, the amount of sulphur varying from 20 to 25 per cen appears to be a mixture of sulphur-compounds of the radical C^6H possible relations of which to allyl C^3H^5 (p. 63) require further in gation. To this however, the insufferable odour of the crude oi serious obstacle.

Oil of asafœtida when treated with oxydizing agents, yields b oxalic acid, acids of the fatty series up to valerianic acid. Pota decomposes it with evolution of gas, forming potassium sulphide residual oil is found to have the odour of cinnamon.

The resin of asafœtida is not wholly soluble in ether or chlor but dissolves with decomposition in warm concentrated nitric aci contains *Ferulaic Acid*, $C^{10}H^{10}O^4$, discovered by Hlasiwetz and in 1866, crystallizing in iridescent needles soluble in boiling w it is homologous with *Eugetic Acid*, $C^{11}H^{12}O^4$. Fused with p ferulaic acid yields oxalic and carbonic acids, fatty acids, and lil

[1] A large specimen of it was kindly presented to one of us (H.) by Mr. D. S. Kemp of Bombay. We have also examined the same drug in the India Museum.

[2] *Hist. des Drogues*, iii. (1850) 22

[3] *Hist. Plantarum*, l. vi. c. 3.

[4] *Gommes-résines des Ombellifères* Paris, 1869. 32.

huic acid. The resin itself treated in like manner after it has iously freed from gum, yields resorcin; and by dry distillation, green, blue, violet or red tint, besides about ¼ per cent. of *rone*, $C^9H^6O^3$.

nerce—The drug is at the present day produced exclusively istan. Much of it is shipped in the Persian Gulf for Bombay is conveyed to Europe; it is also brought into India by way rur, and by the Bolan pass in Beluchistan.

e year 1872–73, there were imported into Bombay[1] by sea, m the Persian Gulf, 3367 cwt. of asafœtida, and 4780 cwt. of e form of the drug called *Hingra*. The value of the latter is fifth that of the genuine kind known as *Hing*. The export ida from Bombay to Europe is very small in comparison with ents to other ports of India.

—Asafœtida is reputed stimulant and antispasmodic. It is in and on the Continent, but is little employed in Great Britain. e Mahommedan as well as Hindu population of India, it is used as a condiment, and is eaten especially with the various own as *dál*. In regions where the plant grows, the fresh leaves l as an article of diet.

eration—The systematic adulteration chiefly with earthy eady pointed out, may be easily estimated by exhausting the solvents and incinerating the residue.

GALBANUM.

esina Galbanum; Galbanum; F. *Galbanum;* G. *Mutterharz.*

ical Origin—The uncertainty that exists as to the plants nish asafœtida, hangs over those which produce the nearly allied *anum*. Judging from the characters of the latter, it can scarcely d that it is yielded by umbelliferous plants of at least two hich are probably the following:[2]—

ula galbaniflua Boiss. et Buhse,[3]—a plant with a tall, solid stem, high, greyish, tomentose leaves, and thin flat fruits, 5 to 6 lines 3 broad, discovered in 1848 at the foot of Demawend in Northern l on the slopes of the same mountain at 4,000 to 8,000 feet, also ntains near Kuschkäk and Churchurä (Jajarúd ?). Bunge col- same plant at Subzawar. Buhse says that the inhabitants of the Demawend collect the gum resin of this plant which is *Galba-* tears which exude spontaneously from the stem, especially on its and about the bases of the leaves, are at first milk-white but ellow by exposure to light and air. It is not the practice, so observed, to wound the plant for the purpose of causing the

t of the Trade and Navigation for the year 1872-73, pt. ii. 26.

wing in addition have at various upposed to afford galbanum:— *banifera* Koch, a native of the n region and Southern Russia; *Opoidia galbanifera* Lindl., a Persian plant of doubtful genus; *Bubon Galbanum* L., a shrubby umbellifer of South Africa.

[3] *Aufzählung der in einer Reise durch Transkaukasien und Persien gesammelten Pflanzen.—Nouv. Mém. de la Soc. imp. des Nat. de Moscou*, xii. (1860) 99.

juice to exude more freely, nor is the gathering of the gum i district any special object of industry.[1] The plant is called in P *Khassuih*, and in the Mazanderan dialect *Boridsheh*.

2. *F. rubricaulis* Boiss.[2] (*F. erubescens* Boiss. ex parte, Aucher a 4614, Kotschy n. 666).—This plant was collected by Kotschy in go the Kuh Dinar range in Southern Persia, and probably by Aucher-I the mountain of Dalmkuh, in Northern Persia. Borszczow,[3] who i it as the same as the preceding (though Boissier[4] places it in a d section of the genus), says on the authority of Buhse, that it occurs throughout the whole of Northern Persia, is found in plenty on the of Elwund near Hamadan, here and there on the edge of the great salt-desert of Persia, on the mountains near Subzawar, between C and Kháf, west of Herat, and on the desert plateau west of Kh states, though not from personal observation, that its gum-resin constitutes *Persian Galbanum*, is collected for commercial p around Hamadan. *F. rubricaulis* Boiss. has been beautifully by Berg[5] under the name of *F. erubescens*.

History—Galbanum, in Hebrew *Chelbenah*, was an ingredier incense used in the worship of the ancient Israelites,[6] and is me by the earliest writers on medicine as Hippocrates and Theopl Dioscorides states it to be the juice of a *Narthex* growing in Sy describes its characters, and the method of purifying it by ho exactly as followed in modern times. We find it mentioned in century among the drugs on which duty was levied at the custom house at Alexandria.[8] Under the name of *Kinnah* it v known to the Arabians, and through them to the physicians school of Salerno.

In the journal of expenses of John, king of France, during hi vity in England, A.D. 1359–60, there is an entry for the purchase of Galbanum which cost 16s., 1 ℔. of Sagapenum (*Serapin*) at t time costing only 2s.[9] In common with other products of the Ea drugs used to reach England by way of Venice and are mentione the exports of that city to London in 1503.[10]

An edict of Henry III. of France promulgated in 1581, g prices per ℔. of the gum-resins of the *Umbelliferæ* as follows :—O 32 sols, Sagapenum 22 sols, Asafœtida 15 sols, Galbanum 10 so moniacum 6 sols 6 deniers.[11]

Description—Galbanum is met with in drops or tears, a *inter se* into a mass, usually compact and hard, but sometimes f soft as to be fluid. The tears are of the size of a lentil to t hazel-nut, translucent, and of various shades of light brown, ye

[1] Buhse, l. c. ; also *Bulletin de la Soc. imp. des Nat. de Moscou*, xxiii. (1850) 548.

[2] *Diagnoses Plantarum novarum præsertim orientalium*, ser. ii. fasc. 2 (1856) 92.

[3] Op. cit. 36 (see p. 280, note 3).

[4] *Flora Orientalis*, ii. (1872) 995.

[5] Berg. u. Schmidt, *Offizinelle Gewächse*, iv. (1863) tab. 31 *b*.

[6] Exodus xxx. 34.—In imitation of the ancient Jewish custom, Galbanum is a component of the incense used in the Irvingite chapels in London.

[7] Χαλβάνη—Theophr. *Hist. Plan*

[8] Vincent, *Commerce of the An* (1807) 692.

[9] Doüet d'Arcq, *Comptes de l'* *des Rois de France* (1851) 236.—T must be multiplied by 3 to give a present value.

[10] Pasi, *Tariffa de Pesi e Misu* 1521. 204 (1st edition, 1503).

[11] Fontanon, *Edicts et Ordonnanc de France*, ii. (1585) 388.

reenish. The drug has a peculiar, not unpleasant, aromatic
ı disagreeable, bitter, alliaceous taste.
variety, the tears are dull and waxy, of a light yellowish
esh, but becoming of an orange-brown by keeping; they are
isposed to run together, and are sometimes quite dry and
ın odour that somewhat reminds one of savine. In recent
ɜ of this form of galbanum, we have noticed a considerable
ıf thin transverse slices of the root of the plant, an inch or
meter.

:al Composition—Galbanum contains volatile oil, resin an
The first, of which 7 per cent. may be obtained by distillatio
is a colourless liquid, boiling at 160–165° C., and having the
ɜ drug; it deviates the ray of polarized light to the right, and
ı treated with dry hydrochloric acid, a crystalline compound,

in, which we find to constitute about 60 per cent. of the
ry soft, and dissolves in ether or in alkaline liquids, even
ime, but only partially in bisulphide of carbon. When heate
ne at 100° C. with hydrochloric acid, it yields about 0·8 per
ıbelliferone, $C^9H^6O^3$, which may be dissolved from the acid
ıeans of ether or chloroform; it is obtained on evaporation
ɜs acicular crystals. Umbelliferone is soluble in water; its
hibits, especially on addition of an alkali, a brilliant blue
: which is destroyed by an acid. If a small fragment of galba-
ersed in water, no fluorescence is observed, but it is immediately
y a drop of ammonia.[1] The same phenomenon takes place
tida, and in a slight degree with ammoniacum; it is pro-
to traces of umbelliferone pre-existing in those drugs.
ıferone is also produced from many other aromatic umbel-
nts, as *Angelica*, *Levisticum*, and *Meum*, when their respective
ubmitted to dry distillation. According to Zwenger (1860)
likewise obtained from the resin of *Daphne Mezereum* L.
is always small; it is highest in galbanum, but even in
ıot much exceed 0·8 per cent. reckoned on the crude drug.
nitting galbanum-resin to dry distillation, Mössmer (1861)
thick oil of an intense and brilliant blue,[2] which was noticed
1751 by Caspar Neumann of Berlin. It is a liquid having a
matic odour and a bitter acrid taste. Kachler (1871) found
.d be resolved by fractional distillation into a colourless oil
formula $C^{10}H^{16}$, and a blue oil to which he assigned the com-
$H^{16}O$, or perhaps more correctly $C^{40}H^{64}O^4$, boiling at 289° C.
ydrocarbon, it boils at 240° C., and therefore differs from the
l obtained when galbanum is distilled with water. The blue
ıe purification agrees, according to Kachler, with the blue oil
ɜrs of *Matricaria Chamomilla* L. Each may be transformed

ırkable property of umbelli-
beautifully shown by dipping
paper into water which has
our or two on lumps of gal-
ying it. A strip of this paper
t tube of water with a drop of
give a superb blue solution,
instantly losing its colour on the addition of
a drop of hydrochloric acid.

[2] We have found it best to mix the gal-
banum-resin with coarsely powdered pumice-
stone; the oil is then easily and abundantly
obtainable.

by means of potassium into a colourless hydrocarbon, $C^{10}H^{16}$;[1] anhydride of phosphoric acid into another product, $C^{10}H^{14}$, li colourless. The latter, as well as the former hydrocarbon, if dilute ether, and bromine be added, assumes for a moment a fine blue tin

The blue oil, $C^{10}H^{16}O$, is not the only product of the dry disti of galbanum-resin. We have observed that acids are also abun formed, which may be separated from the oil by washing it with

When cooled, the crude blue oil sometimes deposits crystals belliferone, which are also obtained if the acidulous water just me is concentrated, and then shaken with chloroform.

By fusing galbanum-resin with potash, Hlasiwetz and Barth obtained crystals (about 6 per cent.) of *Resorcin*, together with ac volatile fatty acids. The empirical formula of resorcin, C^6H likewise that of pyrocatechin and hydrokinone. Resorcin ha agreeable sweet taste; it is soluble in water, alcohol, ether, bis of carbon, or chloroform. It melts at 104° C. and distills at Resorcin, which is a very interesting body from a theoretical view, is more abundantly produced if the crystalline portion extracts of Sapan Wood (*Cæsalpinia Sappan* L.) or of Brazi (*C. echinata* Lam.), is submitted to dry distillation, or melt potash.

Galbanum-resin treated with nitric acid, yields *Camphretic A Styphnic Acid.*[2]

If galbanum, or still better its resin, is warmed with conc hydrochloric acid, a red hue is developed, which turns violet o if spirit of wine is slowly added. Asafœtida treated in the s assumes a dingy greenish colour, and *ammoniacum is not altere* This test probably depends upon the formation of resorcin, itself is not coloured by hydrochloric acid, but assumes a red colour if sugar or mucilage or certain other substances are It is remarkable that ammoniacum, though likewise yielding when fused with potash, assumes no red colour when warm hydrochloric acid. The mucilage of galbanum has not been examined.

Commerce—Galbanum is we believe, brought into commerc from Eastern Europe. It is stated that considerable quantiti Russia by way of Astrachan and Orenburg.

Uses—Galbanum is administered internally as a stimulatin torant, and is occasionally applied in the form of plaster to swellings.

AMMONIACUM.

Gummi-resina Ammoniacum; Ammoniacum or Gum Ammon
F. *Gomme-résine Ammoniaque*; G. *Ammoniak-gummiha*

Botanical Origin—*Dorema Ammoniacum* Don (*Diserneston ferum* Jaub. et Spach), a perennial plant, with a stout, erect flower-stem, 6 to 8 feet high, dividing towards its upper

[1] Probably identical with that obtained by fractional distillation, as previously mentioned.

[2] Gmelin's *Chemistry*, xi. 228.

nerous ascending branches, along which are disposed on thick short ks, ball-like simple umbels, scarcely half an inch across, of very ll flowers. The aspect of the full-grown plant is therefore very ike that of *Ferula*. The *Dorema* has large compound leaves with ad lobes. The whole plant in its young state is covered with a entum of soft, stellate hairs, which give it a greyish look, but which ppear as it ripens its fruits. The withered stems long remain erect, occurring in immense abundance and overtopping the other vege- on of the arid desert, have a striking appearance.[1]

The plant occurs over a wide area of the barren regions of which ia is the centre. According to Bunge and Bienert, its north-western t appears to be Shahrud (S.E. of Asterabad), whence it extends east- l to the deserts south of the Sea of Aral and the Sir-Daria. The southern point at which the plant has been observed, is Basiran, lage of Southern Khorassan in N. lat. 32°, E. long. 59°.

Of the three or four other species of *Dorema*, *D. Aucheri* Boiss. ds very good ammoniacum, as we know by an ample specimen of the deposited together with the plant in the British Museum by Mr. C. Loftus, who in 1851 collected both at Kirrind in Western Persia, e the plant is called in Kurdish *Zuh*. Boissier[2] includes as *D. ieri* another plant, called by Loftus *D. robustum*, the gum of which rtainly different from ammoniacum. Of the plant itself, there are *fruits* in the British Museum.

History—The first writer to mention ammoniacum is Dioscorides, states it to be the juice of a *Narthex* growing about Cyrene in a, and that it is produced in the neighbourhood of the temple of non. He says it is of two sorts, the one like frankincense in pure, tears, the other massive, and contaminated with earthy impurities. r gives essentially the same account.

he succeeding Greek and Latin authors on medicine throw but little on the drug, which however is mentioned by most of them as used imigation. Hence we find such terms as *Ammoniacum thymiama*, *oniacum suffimen*, *Thus Libycum*.

he African origin assigned to the drug by Dioscorides has long exed pharmacologists; but it is now well ascertained that in Morocco ge species of *Ferula* (according to Lindley *F. Tingitana* L.), yields ky gum-resin having some resemblance to ammoniacum, and still ject of traffic with Egypt and Arabia, where it is employed, like the nt drug, *in fumigations*. There can be but little doubt we think, he ammoniacum of Morocco is identical with the ammoniacum of ncients; it may well have been imported by way of Cyrene from is lying further westward.[3]

ersian ammoniacum or the ammoniacum of European commerce, also have been known in very remote times, though we are unable ce it back earlier than the 10th century, at which period it is men- l by Isaac Judæus[4] and by the Persian physician Alhervi.[5] Both

ier, *Journey into Khorasân*, 1825.
olak, *Persien, das Land und seine* 1. (1865) 282.
ra Orientalis, ii. (1872) 1009.
nbury, *Pharm. Journ.* March 22, 41.

[4] *Opera Omnia*, Lugd. 1515, lib. ii. practices c. 44.
[5] Seligmann, *Liber Fundamentorum Pharmacologiæ*, Vindob. 1830. 85.

these writers designate it *Ushak*, a name which it bears in Persia to present day.

Collection—The stem of the plant abounds in a milky juice w flows out on the slightest puncture. The agent which occasions the dation is a beetle, multitudes of which pierce the stem. The gum drops of which speedily harden, partly remains adherent to the stem partly falls to the ground; it is gathered about the end of July by peasants, who sell it to dealers for conveyance to Ispahan or the co

Young roots, 3 to 4 years old, are according to Borszczow, extre rich in milky juice which sometimes exudes into the surrounding s large drops; there is also an exudation from the fibrous crown o root of a dark inferior sort of ammoniacum. The gum-resin appe be collected in quantity only in Persia. One of the chief localiti it are the desert plains about Yezdikhast, between Ispahan and Shi

Description—Ammoniacum occurs in dry grains or tears of rou form, from the size of a small pea to that of a cherry, or in no lumps. They are externally of a pale creamy yellow, opaque milky-white within. By long keeping, the outer colour darkens cinnamon-brown. Ammoniacum is brittle, showing when broken waxy lustre, but it easily softens with warmth. It has a bitter taste, and a peculiar, characteristic, non-alliaceous odour. It re forms a white emulsion when triturated with water. It is col yellow by caustic potash. Hypochlorites, as common bleaching po give it a bright orange hue, while they do not affect the Morocco d

Ammoniacum is obtained from the mature plant, the ripe meri of which, $\frac{3}{8}$ of an inch in length, are often found sticking to the By pressure the tears agglutinate into a compact mass, which i *Lump Ammoniacum* of the druggists. It is generally less pure th detached grains, and fetches a lower price.

Chemical Composition—Ammoniacum is a mixture of v oil with resin and gum. The greater or less softness of the d partly due, as in all analogous substances, to the proportion of present.

The volatile oil, which is lighter than water and has the precise of the drug, contains according to our experiments, no sulph similar observation was made by Przeciszewski.[2] Vigier,[3] who ob the oil to the extent of 1·8 per cent. by distilling the gum-resi water, asserts that it blackens silver, and that after oxidation with acid, he detected in it sulphuric acid. He states that with hydro acid, the oil acquires a fine violet tint passing by all shades to we failed in obtaining this coloration.

The resin in ammoniacum usually amounts to about 70 per ce is separable according to Przeciszewski, into two substances,—the resin having acid properties, the other an indifferent resin. He that the indifferent resin when heated yields sulphuretted hyd Our own experiments failed to show the presence of sulphur

[1] Johnson, *Journey from India to England through Persia*, &c., 1818. 93. 94; Hart, quoted by Don, *Linn. Trans.* xvi. (1833) 605.

[2] *Pharmakologische Untersuchungen über Ammoniacum, Sagapenum und O* Dorpat, 1861.

[3] *Gommes-résines des Ombellifères* Paris, 1869. 93.

g; and the same negative result has been more recently obtained
areful experiments by Moss.[1]
e the gum-resin of allied plants, ammoniacum yields no um-
e. When melted with caustic potash it affords a little resorcin.
wski found the gum to agree with that of acacia.

nerce—Ammoniacum is shipped to Europe from the Persian
way of Bombay. The exports from the latter place in the year
were 453 cwt., all shipped to the United Kingdom. The
imported into Bombay in 1872–73 was 1671 cwt., all from the
ulf.[2]

—The drug is administered as an expectorant and is also used
plasters.

Allied Gum-resins.

penum—This is a gum-resin which, when pure, forms a tough
ass of closely agglutinated tears. It is nearly related to
, but differs from that substance in forming brownish (not
te) tears, which when broken do not acquire a pink tint; also
ving so powerful an alliaceous odour.
enum, which in mediaeval pharmacy was often called *Sera-*
so frequently mentioned by the older writers that it must
a plentiful substance. At the present day it can scarcely
ed genuine even at Bombay, whither it is sometimes brought
ia. The botanical origin of the drug is unknown.

anax—A gum-resin occurring in hard, nodular, brittle, earthy-
mps of a bright orange-brown hue, and penetrating offensive
minding one of crushed ivy-leaves. It is commonly attributed
nax Chironium Koch, a native of Mediterranean Europe. We
er seen a specimen known to have been obtained from this
it can say that the gum-resin of the nearly allied *Opopanax*
Boiss., as collected by Loftus at Kirrind in Western Persia in
neither the appearance nor the characteristic odour of officinal
. Powell,[3] who has recently endeavoured to trace the origin of
regards it as a product of Persia.
nax was very common in old pharmacy, but has fallen out of
s now both rare and expensive.[4]

FRUCTUS ANETHI.

nen Anethi; Dill Fruits, Dill Seeds; F. *Fruits d'Aneth;*
G. *Dillfrüchte.*

nical Origin—*Anethum*[5] *graveolens* L., an erect, glaucous
ant, with finely striated stems usually 1 to 1½ feet high, pinnate
h setaceous linear segments, and yellow flowers.

Journ. March 29, 1873. 761.
t of the Trade and Navigation
ency of Bombay, 1871-72, and

e Products of the Punjab, i.

particulars regarding Sagapenum and Opopanax, may be found in the theses of Przeciszewski (1861) and Vigier (1869), noticed in our article on Ammoniacum.

[5] Bentham and Hooker (*Gen. Plant.* i. 919) suppress the genus *Anethum*, uniting its one solitary species with *Peucedanum*.

It is indigenous to the Mediterranean region, Southern Russia the Caucasian provinces, but is found as a cornfield weed in many o countries, and is frequently cultivated in gardens.

Dill, under the Hindustani name of *Suvà* or *Sóyah*, is largely gr in various parts of India, where the plant though of but a few mo duration, grows to a height of 2 to 3 feet. On account of a sl peculiarity in the fruit, the Indian plant was regarded by Roxburgh De Candolle as a distinct species, and called *Anethum Sowa*, bu possesses no botanical characters to warrant its separation from *graveolens*.

History—Dill is commonly regarded to be the Ἄνηθον of Dioscor the *Anethum* of Palladius and other ancient writers, as well as of New Testament.[1] In Greece the name Ἄνηθον is at present app to a plant of very similar appearance, *Carum Ridolfia* Benth. et E (*Anethum segetum* L.) By the later Greeks, the term Ἀθήνιον was used for dill.[3]

Dill, as well as coriander, fennel, cumin, and ammi, was in freq requisition in Britain in Anglo-Saxon times.[4] The name is de according to Prior[5] from the old Norse word *dilla, to lull*, in allusi the reputed carminative properties of the drug. However this ma we find the word occurring in the 10th century in the Vocabula Alfric, archbishop of Canterbury.[6] The words *dill* and *till*, undoub meaning this drug, were also used in Germany and Switzerland as as A.D. 1000.

Description—The fruit which has the characters usual to *U liferæ*, is of ovoid form, much compressed dorsally, surrounded w broad flattened margin. The mericarps about $\frac{1}{10}$ of an inch wid mostly separate; they are provided with 5 equidistant, filiform rid which the two lateral lose themselves in the paler, broad, thin m The three others are sharply keeled; the darker space between th occupied by a vitta and two occur on the commissure. In the I drug, the mericarps are narrower and more convex, the ridges distinct and pale, and the border less winged. In other respe accords with that of Europe. The odour and taste of dill are agr aromatic.

Microscopic Characters—The pericarp is formed of a small n of flattened cells, which in the inner layer are of a brown colou ridges consist as usual of a strong fibro-vascular bundle. The in a transverse section present an elliptic outline $\frac{1}{140}$ of an inch in diameter. The margin of the mericarp is built up of porous, chymatous tissue. The albumen as in the seeds of all umbe consists of somewhat thick-walled, angular cells, loaded with fat and globular grains of albuminous matters which present a dark when examined by polarized light. In dill, these grains are abou 5 mkm. in diameter.

[1] Matt. xxiii. 23,—where it has been rendered *anise* by the English translators from Wicklif (1380) downwards. But in other versions, the word is correctly translated.

[2] Heldreich, *Nutzpflanzen Griechenlands* (1862) 40.

[3] Langkavel, *Botanik d. späteren Griechen*, Berlin, 1866. 39.

[4] *Leechdoms*, &c., edited by Co 1864-66,—see especially *Herbarium leii*, dating about A.D. 1050, in Vol 219. 235. 237. 281. 293.

[5] *Popular Names of British Pla d.*

[6] *Volume of Vocabularies*, edi Wright, 1857. 30.

Chemical Composition—Dill fruits yield on an average 2·8 per nt. (3·7 per cent. Pereira) of an essential oil, a large proportion of hich was found by Gladstone (1864–1872) to be a hydrocarbon, $C^{10}H^{16}$, which he gave the name *Anethene*. This substance has a lemon-like lour, sp. gr. ·846, and boils at 173° C. It deviates a ray of polarized ght strongly to the right.

Oil of dill also contains an oxygenated oil, $C^{10}H^{14}O$, regarded by ladstone as identical with carvol. It may be obtained as this chemist ates[1] either by fractional distillation (an imperfect method), or by king advantage of the fact that oils of this group form crystalline dies with hydrosulphuric acid, which can be easily purified and which eld the original oil when decomposed by an alkali. The oxidised oil m dill has the same odour as that from caraway, and likewise forms a rstalline compound when treated with sulphide of ammonium in ohol. It has a sp. gr. of ·956, and rotates the polarized ray to the ht. Nothing is known of the other constituents of dill fruits.

Uses—The distilled water of dill is stomachic and carminative, and quently prescribed as a vehicle for more active medicines. The seeds much used for culinary and medicinal purposes by the people of lia, but are little employed in Continental Europe.

FRUCTUS CORIANDRI.

Semen Coriandri; Coriander Fruits, Coriander Seeds, Corianders;
F. *Fruits de Coriandre*; G. *Koriander.*

Botanical Origin—*Coriandrum sativum* L., a small, glabrous, annual nt, apparently indigenous to the Mediterranean and Caucasian regions, it now found as a cornfield weed throughout the temperate parts of rope and Asia. It is cultivated in many countries, and has thus nd its way even to Paraguay. In England the cultivation of coriander s long been carried on, but only to a very limited extent.

History—The plant owes its names Κόριον, Κορίαννον, and Κοριάν-ον to the offensive odour it exhales when handled, and which reminds n of bugs,—in Greek Κόρις. This character caused it to be regarded the middle ages as having poisonous properties.[2] The ripe fruits hich are entirely free from the fœtid smell of the growing plant, re used as a spice by the Jews and the Romans, and in medicine from very early period. Cato, who wrote on agriculture in the 3rd century C., notices the cultivation of coriander. Pliny states that the best is at of Egypt.

Coriander, or as sometimes called *Coliander*, was well known in itain prior to the Norman Conquest, and often employed in ancient glish medicine and cookery.

Cultivation—Coriander, called by the farmers *Col*, is cultivated in eastern counties of England, especially in Essex. It is sometimes n with caraway, and being an annual is gathered and harvested the t year, the caraway remaining in the ground. The seedling plants

[1] *Journ. of Chemical Society*, x. (1872) 9; *Chem. News*, March 1872. 746.

[2] P. de Abbano, *Tract. de Venenis*, 1473, capp. 25. 46.

are hoed so as to leave those that are to remain, in rows 10 to 12 inches apart. The plant is cut with sickles, and when dry the seed is thrashed out on a cloth in the centre of the field. On the best land, 15 cwt. per acre is reckoned an average crop.[1]

Description—The fruit of coriander consists of a pair of hemi spherical mericarps, firmly joined so as to form an almost regular glob measuring on an average about $\frac{1}{8}$ of an inch in diameter, crowned by th stylopodium and calycinal teeth, and sometimes by the slender divergi styles. The pericarp bears on each half, 4 perfectly straight sharp ridges, regarded as secondary (*juga secundaria*); two other ridges, oft of darker colour, belonging to the mericarps in common, the se ration of which takes place in a rather sinuous line. The shallow pression between each pair of these straight ridges, is occupied b zigzag raised line (*jugum primarium*), of which there are therefore each mericarp. It will thus be seen that each mericarp has 5 (zig so-called *primary ridges*, and 4 (keeled and more prominent) *second* besides the lateral ridges which mark the suture or line of separa There are no vittæ on the outer surface of the pericarp. Of the 5 t of the calyx, 2 often grow into long, pointed, persistent lobes: proceed from the outer flowers of the umbel.

Though the two mericarps are closely united, they adhere onl the thin pericarp, enclosing when ripe a lenticular cavity. On each of this cavity, the skin of the fruit separates from that of the seed, playing the two brown vittæ of each mericarp. In transverse sec the albumen appears crescent-shaped, the concave side being toward cavity. The carpophore stands in the middle of the latter as a col connected with the pericarp only at top and bottom.

Corianders are smooth and rather hard, in colour buff or light b They have a very mild aromatic taste, and when crushed a pe fragrant smell. When unripe, their odour, like that of the fresh is offensive. The nature of the chemical change that occasions alteration in odour has not been made out.

The Indian corianders shipped from Bombay are of large size a elongated form.

Microscopic Structure—The structural peculiarities of cori fruit chiefly refer to the pericarp. Its middle layer is made up of t walled ligneous prosenchyme, traversed by a few fibro-vascular bu which in the zigzag ridges vary exceedingly in position.

Chemical Composition—The essential oil of coriander has a position indicated by the formula $C^{10}H^{18}O$, and is therefore iso with borneol. If the elements of water are abstracted by phos anhydride, it is converted according to Kawalier (1852) into an offensive odour, $C^{10}H^{16}$.

The fruits yield of volatile oil about $\frac{1}{2}$ per cent.; as the vittæ ar protected by the woody pericarp, corianders should be bruised being submitted to distillation. Trommsdorff found the fruits to 13 per cent. of fixed oil.

The fresh herb distilled in July when the fruits were far from yielded to one of us (F.) from 0·57 to 1·1 per mille of an essent possessing in a high degree the disagreeable odour already allu

[1] R. Baker, in Morton's *Cyclopedia of Agriculture*, i. (1855) 545.

'as found to deviate the ray of polarized light 1·1° to the right nined in a column 50 mm. long. The oil distilled by us :ommercial fruit deviated 5·1° to the right.

ction and Commerce—Coriander is cultivated in various 'ontinental Europe, and as already stated, to a small extent L It is also produced in Northern Africa and in India. In the export of coriander from the province of Sind[1] was 948 . Bombay[2] in the same year 619 cwt. From Calcutta[3] there ed in 1870–71, 16,347 cwt.

–Coriander fruits are reputed stimulant and carminative, yet le employed in medicine. They are however used in veteri- ice, and by the distillers of gin, also in some countries in

FRUCTUS CUMINI.

Semen Cymini; Cumin or Cummin[4] *Fruits, Cummin Seeds ines de Cumin; G. Mutterkümmel, Kreuzkümmel, Langer oder cher Kümmel, Mohrenkümmel.*

ical Origin—*Cuminum Cyminum* L., a small annual plant, to the upper regions of the Nile, but carried at an early period tion to Arabia, India and China, as well as to the countries he Mediterranean. The fruits of the plant ripen as far north n Norway; but in Europe, Sicily and Malta alone produce tantity.

y—Cumin was well known to the ancients; it is alluded to rew prophet Isaiah,[5] and is mentioned in the gospel of Mat- one of the minor titheable productions of the Holy Land. name Κύμινον, it is commended for its agreeable taste by s, in whose day it was produced on the coasts of Asia Minor rn Italy. It is named as *Cuminum* by Horace and Persius. the middle ages, cumin was one of the spices in most common in A.D. 716, an annual provision of 150 lb. of cumin for the of Corbie in Normandy, was not thought too large a supply.[7] requent use in England, its average price between 1264 and a little over 2*d.* per lb.[8] Cumin is enumerated in the *Liber* he city of London, compiled in 1419, among the merchandize he king levied the impost called *scavage*; and is mentioned[10] one of the articles of which the Grocers' Company had the nd oversight.

ption—The fruit, the colour of which is brown, has the usual

of the Trade and Navigation year 1872–73, Karachi, 1873.

Bombay, 1872–73. ii. 90.

Volume of Trade, &c. for the ear, 1870–71. 121.

Wicklif's Bible (1380), *Com- le's* (1534), *Commyn* in Cran- *Cummine* in the Authorized , *Cumin* in Gerarde's *Herbal* 'aris's *Pharmacologia* (1822), *Cummin*, Ray (1693) and in modern trade- lists and price-currents.

[5] Ch. xxviii. 25–27.

[6] Ch. xxiii. 23.

[7] Pardessus, *Diplomata*, etc., Paris, 1849. ii. 309.

[8] Rogers, *Hist. of Agriculture and Prices in England*, 1866. i. 631, ii. 543–547.

[9] *Munimenta Gildhalla Londoniensis*, edited by Riley, i. (1859) 224.

[10] Herbert, *Hist. of the Great Livery Companies of London*, 1834. 114.

structure of the order; it is of an elongated ovoid form, tapering to each end, and somewhat laterally compressed. The mericarps whi not readily separate from the carpophore, are about ¼ of an inch in l and $\frac{1}{10}$ of an inch in greatest breadth. Each has 5 primary ridges are filiform, and scabrous or muriculate, and 4 secondary covered rough hairs. Between the primary ridges is a single elongated vitt 2 vittæ occur on the commissural surface. A transverse section o seed shows a reniform outline. There is a form of *C. Cyminu* cultivation, the fruit of which is perfectly glabrous.

Cumin has a strong aromatic taste and smell, analogous to bu less agreeable than that of caraway.

Microscopic Structure—The hairs are rather brittle, some ½ mm. in length, formed of cells springing from the epidermis. larger consist of groups of cells, vertically or laterally combined enclosed by a common envelope; the smaller of but a single cell e in a rounded point. The whole pericarp is rich in tannic matter, str with salts of iron a dark greenish colour.

The tissue of the seed is loaded with colourless drops of a fatt the vittæ with a yellowish-brown essential oil. But the most str contents of the parenchyme of the albumen consist of transp colourless, spherical grains, 7 to 5 mkm. in diameter, several of are enclosed in each cell. Under a high magnifying power, they a central cavity with a series of concentric layers around it, frequ traversed by radial clefts. Examined in polarized light, these g display exactly the same cross as is seen in granules of starch, alth their behaviour with chemical tests at once proves that they are means that substance; in fact iodine does not render them blue, intensely brown. Grains of the same character, assuming somet a crystalloid form, occur in most umbelliferous fruits, and in seeds of other orders. All these bodies are composed of albuminous fatty matters; the more crystalloid form as met with in the see *Ricinus* and in the fruit of parsley, is the body called by Hartig *Al*

Chemical Composition—Cumin fruits yielded to Bley (182 per cent. of fat oil, 13 per cent. of resin (?), 8 of mucilage and gum, of albuminous matter, and a large amount of malates. Their pec strong, aromatic smell and taste, depend on the essential oil of w they afford about 3 per cent. Trapp[1] has shown that the fruits of *C virosa* L. contain the same oil to the extent of about 1¼ per cent. of cumin is a mixture of *Cymol* or *Cymene*, $C^{10}H^{14}$, having sp. gr. and boiling point 177° C.; and *Cuminol* or *Cuminaldehyde*, C^{10} of sp. gr. 0·972, boiling point 236° C., the proportion of the latter i crude oil being about 56 per cent. It also contains the hydroc $C^{10}H^{16}$, according to Warren (1865), and Beilstein and Kupffer (18

Cuminol possesses the smell and taste of cumin, while the odo cymol more resembles that of lemons. Oil of cumin deviates a polarized light 10·2° to the right: the optical power of each of its stituents is nearly the same, that of cuminol being the less st Cymol may also be obtained by submitting coal-tar to dry distill or by distilling camphor with anhydrous phosphoric acid or dry ch

[1] *Ann. der Chem. u. Pharm.* cviii. (1858) 386.

Oppenheim (1872) has showed[1] that oil of turpentine is to be d as a hydride of cymol, and has indeed transformed terpin, allized hydrate of the former into cymol. In the oil of *Thymus* L., cymol exists ready formed.

nol manifests the chemical properties of an aldehyde, inasmuch ıbines with alkaline bisulphites, and is easily transformed by agents into the crystallizable *Cuminic* or *Cumic Acid*, . It also slowly oxidizes under the influence of air and water, the same product.[2]

merce—Cumin is shipped to England from Mogador, Malta and In Malta there were in 1863, 140 acres under cultivation with ; in 1865, 730 acres, producing 2766 cwt.[3]

export of cumin from Morocco[4] in 1872 was 1657 cwt.; that nbay in the year 1872–73 was 6766 cwt.;[5] and 20,040 cwt. cutta[6] in the year 1870–71.

ı—Cumin is sold by druggists as an ingredient of curry powders, much larger extent for use in veterinary medicine.

CAPRIFOLIACEÆ.

FLORES SAMBUCI.

'owers; F. *Fleurs de Sureau;* G. *Holunderblüthe, Fliederblumen.*

nical Origin—*Sambucus nigra* L.—a large deciduous shrub tree, indigenous to Southern and Central Europe, Western Asia, ıea, the regions of the Caucasus and Southern Siberia. It is to be a native of England and Ireland, but not to be truly Scotland. In other northern parts of Europe, as Norway and the elder appears only as an introduced plant.

ory—The Romans, as we learn from Pliny, made use in of the plant under notice as well as of the *Dwarf Elder* (*S.* L.) Both kinds were employed in Britain by the ancient and Welsh leeches,[7] and in the medicine of the school of ı.

:ription—The elder produces in the early summer, conspicuous, wered cymes, 4 to 5 inches in diameter, of which the long divides into 5 branches, which subdivide once or several threes or fives, ultimately separating by repeated forking into furrowed pedicels about ¼ of an inch long, each bearing a single In the second or third furcations, the middle flower remains

e der Deutschen Chem. Gesellsch.

ther information on this oil see *emistry*, xiii. (1859) 8. 13; xiv. 144. 148. 183.

cal Tables relating to the Colonial ossessions of the United Kingdom,).

ır Reports, Aug. 1873. 917.

nt of the Trade and Navigation idency of Bombay for 1872–73.

[6] *Annual Volume of Trade, &c. for the Bengal Presidency for* 1870–71. 121.

[7] *Leechdoms, &c. of Early England*, edited by Cockayne, iii. (1866) 324. 347. According to the Rev. Edward Gillett (p. xxxii.), *S. Ebulus* is believed to have been brought to England by the Danes and planted on the battle-fields and graves of their countrymen. In Norfolk it still bears the name of *Danewort* and *blood hilder* (blood elder); also *Physicians of Myddvai*, translated by Pughe, Llandovery, 1851.

short-stalked or sessile, and opens sooner than the rest. In like manner, on the outermost small forks only one of the florets is usually long-stalked. The whole of this inflorescence forms a flattish umbelliform cyme, perfectly glabrous and destitute of bracts.

The calyx is combined with the ovary and bordered with 4 or 5 small teeth. The corolla, which is of a creamy white, is monopetalous with a very short tube and 5 spreading ovate lobes. The stamens which are about as long as the divisions of the corolla and alternate with them, are inserted in the tube of the latter. The yellow pollen which thickly powders the flowers, appears under the microscope 3-pored. The projecting ovary is crowned by a 2- or 3-lobed sessile stigma.

For use in pharmacy, the part of the flower most desirable is the corolla, to obtain a good proportion of which the gathered cymes are left for a few hours in a large heap; the mass slightly heats, the corollas detach themselves, and are separated from the green stalks by shaking, rubbing, and sifting; they require to be then rapidly dried. This done they become much shrivelled and assume a dull yellow tint. When fresh, they have a sweet faint smell, which becomes stronger and somewhat different by drying, and is quite unlike the repulsive odour of the fresh leaves and bark. Dried elder flowers have a bitterish, slightly gummy flavour. On the Continent they are sold with the stalks, i.e. in entire cymes.

Chemical Composition—Elder flowers yield a very small percentage of a butter-like essential oil, lighter than water, and smelling strongly of the flowers; it is easily altered by exposure to the air.[1] The oil is accompanied by traces of volatile acids.

Uses—Elder flowers are only employed in British medicine for making an aromatic distilled water, and for communicating a pleasant odour to lard (*Unguentum Sambuci*). The *leaves* are sometimes used for giving a fine green tint to oil or fat, as in the *Oleum viride* and *Unguentum Sambuci foliorum* of the shops. The bark once much employed, is now obsolete.

RUBIACEÆ.

GAMBIER.

Catechu pallidum, Extractum Uncariæ; Gambier, Pale Catechu, Gambier Catechu, Terra Japonica; F. *Gambir, Cachou jaune;* G. *Gambir.*

Botanical Origin—1. *Uncaria Gambier* Roxb. (*Nauclea Gambir* Hunter), a stout climbing shrub, supporting itself by means of its flower stalks which are developed into strong recurved hooks. It is a native of the countries bordering the Straits of Malacca, and especially of the numerous islands at their eastern end; but according to Crawfurd[2] it does not seem indigenous to any of the islands of the volcanic band. It also grows in Ceylon, where however no use is made of it.

2. *U. acida* Roxb., a plant nearly related to the preceding, and grows

[1] For further information, see Gmelin, *Chemistry*, xiv. (1860) 368.

[2] *Dictionary of the Indian Islands*, 185[illegible] 142.

in the Malayan islands, appears to be used in exactly the same ıner.

History—Gambier is one of the substances to which the name of *ɛchu* or *Terra Japonica* is often applied; the other is *Cutch*, which has ı already described (p. 213). By druggists and pharmaceutists the two :les are frequently confounded, but in the great world of commerce ' are reckoned as quite distinct. In many price-currents and trade-, *Catechu* is not found under that name, but only appears under the ıs *Cutch* and *Gambier*.

Crawfurd asserts that gambier has been exported from time immeial to Java from the Malacca Straits. This statement appears highly tionable. Rumphius, who resided in Amboyna during the second of the 17th century, was a merchant, consul and naturalist; and in e capacities became thoroughly conversant with the products of the ıy Archipelago and adjacent regions, as the six folio volumes of his *ıarium Amboinense* illustrated by 587 plates, amply prove.

Among other plants, he figures[1] *Uncaria Gambier*, which he terms *is uncatus*, and states to exist under two varieties, the one with broad, ıther with narrow leaves. The first form, he says, is called in Malay n *Gatta Gambir*, on account of the bitter taste of its leaves, which rceptible in the lozenges (*trochisci*) called *Gatta Gambir*, so much so one might suppose they were made from these leaves, which how-is not the case. He further asserts that the leaves have a detergent, ıg quality by reason of their bitterness, which is nevertheless not ıse but quite bearable in the mouth: that they are masticated ad of *Pinang* [Betel nut] with *Siri* [leaf of *Piper Betle*] and lime: the people of Java and Bali plant the first variety near their es, for the sake of its fragrant flowers; but though they chew its ıs instead of *Pinang*, it must not be supposed that it is this plant which the lozenges *Gatta* are compounded, or that indeed, is quite rent.

Thus, if we may credit Rumphius, it would seem that the important ıfacture of gambier had no existence at the commencement of the century. As to "*Gatta Gambir*," his statements are scarcely in ·d with those of more recent writers. We may however remark that name is very like the Tamil *Katta Kámbu*, signifying *Catechu*, h drug is sometimes made into little round cakes, and was certainly ge export from India to Malacca and China as early as the 16th ıry (p. 213).

That gambier was unknown to Europeans long after the time Rumphius, is evident from other facts. Stevens, a merchant of ıay, in his *Compleat Guide to the East India Trade*, published in , quotes the prices of goods at Malacca, but makes no allusion to ier. Nor is there any reference to it in Savary's *Dictionnaire de ıerce* (ed^n. of 1750), in which Malacca is mentioned as the great pıt of the trade of India with that of China and Japan.

ıe first account of gambier known to us, was communicated to the ıian Society of Arts and Sciences in 1780, by a Dutch trader named ·rus. This person narrates[2] how the plant was introduced into

[1] *Herb. Amb.* v. 63. tab. 34.

[2] *Verhandelingen van het Bataviaasch Genootschap*, ii. (derde druk) 217–234.

Malacca from Pontjan in 1758, and how gambier is made from leaves; and names several sorts of the drug, and their prices.

In 1807, a description of—"the drug called *Gutta Gambeer*," an the tree from which it is made, was presented to the Linnean Societ London.[1] The writer, William Hunter, well known for scientific obse tions in connection with India, states that the substance is made chi at Malacca, Siak and Rhio, that it is in the form of small squares little round cakes almost perfectly white, and that the finer sorts used for chewing with betel leaf in the same manner as catechu, w the coarser are shipped to Batavia and China for use in tanning dyeing.

Manufacture—The gambier plant is cultivated in plantati These were commenced in 1819 in Singapore, where there were at time 800 plantations; but owing to scarcity of fuel, without an abun supply of which the manufacture is impossible, and dearness of lat gambier-planting was in 1866 fast disappearing from the island.[2] official Blue Book printed at Singapore in 1872, reports it as "s *increased.*" It is largely pursued on the mainland (Johore), and in islands of the Rhio-Lingga Archipelago, lying south-east of Singa On the island of Bintang, the most northerly of the group, there we 1854, 1,250 gambier-plantations.

The plantations are often formed in clearings of the jungle, w they last for a few years and are then abandoned[3] owing to the poverishment of the soil and the irrepressible growth of the *la* grass (*Imperata Kœnigii* P. de B.), which is more difficult to erad than even primæval jungle. It has been found profitable to combine the cultivation of gambier that of pepper, for which the boiled leav the gambier form an excellent manure.

The gambier plants are allowed to grow 8 to 10 feet high, and as foliage is always in season, each plant is stripped 3 or 4 times in year. The apparatus and all that belongs to the manufacture of extract, are of the most primitive description.[4] A shallow cast-iron about 3 feet across, is built into an earthen fireplace. Water is po into the pan, a fire is kindled, and the leaves and young shoots, fre plucked, are scattered in, and boiled for about an hour. At the en this time, they are thrown on to a capacious sloping trough, the l end of which projects into the pan, and squeezed with the hand so the absorbed liquor may run back into the boiler. The decoction is evaporated to the consistence of a thin syrup, and baled out into buc When sufficiently cool, it is subjected to a curious treatment:—ins of simply stirring it round, the workman pushes a stick of soft woo a sloping direction into each bucket; and placing two such buckets b him, he works a stick up and down in each. The liquid thickens n the stick, and the thickened portion being constantly rubbed off, whi the same time the whole is in motion, it gradually sets into a mass, a r which the workman affirms would never be produced by simple sti round.[5] Though we are not prepared to concur in the worku

[1] *Linn. Trans.* ix. (1808) 218-224.

[2] Collingwood, *Journ. of Linn. Soc.*, Bot., x. (1869) 52.

[3] This abuse of land has been repressed in Singapore.

[4] We borrow the following accoun is the best we have met with, from *Singapore, Malacca, und Java*, Berlin, 64.

[5] Whether the kind of wood us

, it is reasonable to suppose that his manner of treating the ıvours the crystallization of the catechin in a more concrete form might otherwise assume. The thickened mass, which is said by writer to resemble soft yellowish clay, is now placed in shallow ɔxes, and when somewhat hardened, is cut into cubes and dried ıhade. The leaves are boiled a second time, and finally washed r, which water is saved for another operation.

lantation with five labourers, contains on an average 70,000 to shrubs, and yields 40 to 50 catties (1 catty = 1⅓ lb) of gambier

cription—Gambier is an earthy-looking substance of light brown ısisting of cubes about an inch each side, more or less agglutinated, in the form of entirely compact masses. The cubes are exter- a dark reddish brown and compact, internally of a pale cinnamon ', porous, friable, devoid of odour, but with a bitterish astringent coming subsequently sweetish. Under the microscope, the cubes ɔier are seen to consist of very small acicular crystals.

mical Composition—In a chemical point of view, gambier ith cutch, especially with the pale variety made in Northern India . Both substances consist mainly of *Catechin* or *Catechuic Acid;* ɪ be obtained in the hydrated state as slender colourless needles, ıusting gambier with cold water, and crystallizing the residue or 4 parts of hot water. Gambier, like cutch, dissolves in hot orming a liquid which on cooling deposits a copious precipitate. hloride strikes with this solution much diluted, a green tint. ɜ cupric solutions throw down from a decoction of gambier a red which however does not appear to consist of cuprous oxide.

yellowish colouring matter of gambier was determined by tz (1867) to be *Quercetin*, which is also a constituent of cutch. ıe gambier in regular cubes which we incinerated, left 2·6 per ash, consisting mainly of carbonates of calcium and magnesium. ıy species of *Nauclea* contain, according to De Vry,[1] *Quinovic* is probable that substance may be detected in gambier.

ımerce—Singapore, which is the great emporium for gambier, l in 1871 no less than 34,248 tons, of which quantity 19,550 d been imported into the colony chiefly from Rhio and the ı Peninsula.[2]

quantity imported into the United Kingdom in 1872 was tons, value £451,737, almost the whole being from the Straits nts.

s—Gambier, under the name of *Catechu*, is used medicinally as ngent, but the quantity thus consumed is as nothing in comparison ıt employed for tanning and dyeing.

ıfluences the setting of the liquid, l; but the effect is described by a extraordinary. The wood which used, was that of *Artocarpus* he was told that any sort of soft d answer as well.

[1] *Pharm. Journ.* vi. (1865) 18.

[2] *Blue Book of the Colony of the Straits Settlements for* 1871.

CORTEX CINCHONÆ.

Cortex Peruvianus, Cortex Chinæ; Cinchona Bark, Peruvian Bar
F. *Ecorce de Quinquina;* G. *Chinarinde.*

Botanical Origin—The genus *Cinchona* from which the drug u notice is derived, constitutes together with several nearly allied ge the well-characterised tribe *Cinchoneæ* of the order *Rubiaceæ*. This t consists of shrubs or trees with opposite leaves, 2-celled ovary, cap fruit, and numerous minute, vertical or ascending, peltate, winged, a minous seeds.

(**A**). *Remarks on the genus.*—The genus *Cinchona* is distinguishe deciduous stipules, flowers in terminal panicles, 5-toothed superior c tubular corolla expanding into 5 lobes fringed at the margin. corolla is of an agreeable odour, and of a rosy or purplish hu white.

The fruit is a capsule of ovoid or subcylindrical form, dehiscing the base (the fruitstalk also splitting) into two valves, which are together at the apex by the thick permanent calyx. The seeds, 30 t in number, are imbricated vertically; they are flat, winged all roun a broad membrane, which is very irregularly toothed or lacerat the edge.

The Cinchonas are evergreen, with finely-veined leaves, traverse a strong midrib. The thick leafstalk often of a fine red, is sometin sixth the length of the whole leaf, but usually shorter. The leave ovate, obovate, or nearly circular; in some species lanceolate, n cordate, always entire, glabrous or more rarely hirsute, often variab to size and form in the same species.

Among the valuable species, several are distinguished by small called *scrobiculi*, situated on the under side of the leaf, in the ax the veins which proceed from the midrib. These pits sometimes e an astringent juice. In some species they are replaced by tufts of The young leaves are sometimes purplish on the under side several species the full-grown foliage assumes before falling, rich tir crimson or orange.

The species of Cinchona are so much alike that their definition matter of the utmost difficulty, and only to be accomplished by reso to a number of characters which taken singly are of no great impor Individual species are moreover frequently connected together by marked and permanent intermediate forms, so that according to expression of Howard, the whole form a continuous series, the ter members of which are scarcely more sharply separated from the genera, than from plants of their own series.

As to the number and value of the species known, there is diversity of view. Weddell, in 1870, enumerated 33 species an sub-species, besides numerous varieties and sub-varieties. Bentha Hooker,[1] in 1873, estimated the species as about 36.

(**B**). *Area, Climate and Soil.*—The Cinchonas are all natives of S America, where they occur exclusively on the western side of the c

[1] *Genera Plantarum*, ii. 32.

:n 10° N. lat. and 22° S. lat.,—an area which includes por-
ezuela, New Granada, Ecuador, Peru, and Bolivia.

ıts are found in the mountain regions, no species whatever
ı to inhabit the low alluvial plains. In Peru and Bolivia,
f the Cinchona forms a belt, 1300 miles in length, occupying
slope of the Cordillera of the Andes.[1] In Ecuador and New
ɜ tree is not strictly limited to the eastern slopes, but occurs
the Andine ranges.

age altitude of the cinchoniferous region, is given by Weddell
8,000 feet above the sea-level. The highest limit, as noted
is 11,000 feet. One valuable species, *C. succirubra*, occurs
y as low as 2,600 feet. Generally, it may be said that
of the Cinchona zone decreases in proportion as it recedes
uator, and that the most valuable sorts are not found lower
feet.

ıate of the tropical mountain regions in which the Cinchonas
extremely variable,—sunshine, showers, storms, and thick
ating in rapid succession, yet with no very great range of
. A transient depression of the thermometer even to the
int. and not unfrequent hail-showers, may be borne without
y the more hardy species. Yet the mean temperature most
for the generality of species, appears to be 12 to 20° C.
.)

: agencies appear to influence the growth of Cinchona far
the composition of the soil. Though the tree occurs in a
y of geological formations, there is no distinct evidence that
tions control in any marked manner, either the development
or the chemical constitution of its bark. Manure on the
though not increasing perceptibly luxuriance of growth, has
ffect in augmenting the richness of the bark in alkaloids.[2]

cies yielding officinal barks.—The Cinchona Barks of commerce
d by about a dozen species; of these barks the greater number
ed solely in the manufacture of quinine. Those admitted for
ical use, are afforded by the following species:—

hona officinalis Hooker[3]—A native of Ecuador and Peru,
der several varieties. It forms a large tree, having lanceolate
ıves, usually pointed, glabrous and shining on the upper sur-
robiculate on the under. The flowers are small, pubescent
ort lax panicles, and are succeeded by oblong or lanceolate
an inch or more in length.

alisaya Weddell—Discovered by Weddell in 1847,[4] although
ıd been an object of commerce since the latter half of the
ntury.

ɜ inhabits the warmest woods of the declivities which border
of Bolivia and South-eastern Peru, at an altitude of 5,000 to
above the sea-level. More precisely, the chief localities for

say the *eastern* Cordillera, the
ower range being called the
he Coast; no Cinchonas grow

ı, in *Pharm. Journ.* Jan 4,

[3] Figured in *Bot. Magazine*, vol. 89 (1863) tab. 5364, including *C. Condaminea* Humb. et Bonpl. and *C. Uritusinga* Pavon.

[4] *Ann. des Sciences nat.*, Bot. x. (1848) 6, and *Hist. nat. des Quinquinas*, 1849, tab. 3, figured in *Botanical Magazine* 1873. 6052.

the tree are the Bolivian provinces of Enquisivi, Yungas de la Paz, Larecaja or Sorata, Caupolican or Apolobamba, and Muñecas: thence it passes northward into the Peruvian province of Carabaya, suddenly ceasing on the confines of the valley of Sandia, although as Weddell observed, the adjacent valleys are to all appearance precisely similar.

When well grown, *C. Calisaya* has a trunk often twice as thick as a man's body, and a magnificent crown of foliage overtopping all other trees of the forest. It has ovate capsules of about the same length (½ an inch) as the elegant pinkish flowers, which are in large pyramidal panicles. The leaves are 3 to 6 inches long, of very variable form, but usually oblong and obtuse, rarely acute.

A variety named after Joseph de Jussieu who first noticed it, *J. Josephiana*, but known in the country as *Ichu-Cascarilla* or *Cascarilla del Pajonal*, differs from the preceding in that it is a shrub, 6 to 10 feet high, growing on the borders of mountain meadows and of thickets in the same regions as the larger form.

Other forms known in Bolivia as *Calisaya zamba*, *morada*, *verde*, *alta*, and *blanca*, have been distinguished by Weddell as varieties of *C. Calisaya*.

3. *C. succirubra* Pavon,[1]—a magnificent tree, 50 to 80 feet high, formerly growing in all the valleys of the Andes which debouch in the plain of Guayaquil. The tree is now almost entirely confined to the forests of Guaranda on the western declivities of Chimborazo, at 2,000 to 5,000 feet above the level of the sea.

The bark appears to have been appreciated in its native country at an early period, if we may conclude that the *Red Bark* mentioned by La Condamine in 1737, was that under notice. It would seem, however, to have scarcely reached Europe earlier than the second half of the last century.[2] The tree has broadly oval leaves, attaining about a foot in length, nearly glabrous above, pubescent beneath, large terminal panicles of rosy flowers, succeeded by oblong capsules, 1 to 1¼ inch long.

The other species of *Cinchona*, the bark of which is principally consumed by the manufacturers of quinine, will be found briefly noticed together with the foregoing, in the conspectus at page 318.

History—The early native history of Cinchona is lost in obscurity. No undoubted proofs have been handed down, to show that the aborigines of South America had any acquaintance with the medicinal properties of the bark. But traditions are not wanting.

William Arrot,[3] a Scotch surgeon who visited Peru in the early part of the last century, states that the opinion then current at Loxa, was that the qualities and use of the barks of Cinchona were known to the Indians before any Spaniard came among them. Condamine, as well as Jussieu, heard the same statements, which appear to have been generally prevalent at the close of the 17th century.

It is noteworthy on the other hand, that though the Peruvians tenaciously adhere to their traditional customs, they make no use at the present day of Cinchona bark, but actually regard its employment with repugnance.

[1] Figured in Howard's *Nueva Quinologia*, tab. *Chinchona succirubra*.

[2] Howard, l.c. p. 9.

[3] *Phil. Trans.* xl. for 1737–38. 31.

boldt[1] declares that at Loxa, the natives would rather die than ourse to what they consider so dangerous a remedy. Pöppig[2] ound a strong prejudice to prevail among the people of Huanuco Cinchona as a remedy for fevers, and the same fact was observed orth by Spruce[3] in 1861. The latter traveller narrates, that it ossible to convince the *cascarilleros* of Ecuador that their *Red* ald be wanted for any other purpose than dyeing cloth; and n at Guayaquil there was a general dislike to the use of

ham[4] notices the curious fact that the wallets of the native doctors, who from father to son have plied their art since the he Incas, never contain cinchona bark.

ugh Peru was discovered in 1513, and had submitted to the yoke by the middle of the century, no mention has been found brifuge bark with which the name of the country is connected, an the commencement of the 17th century.

h de Jussieu,[5] who visited Loxa in 1739, relates that the use medy was first made known to a Jesuit missionary, who being by intermittent fever, was cured by the bark administered to him ndian cacique at Malacotas, a village near Loxa. The date of it is not given. The same story is related of the Spanish r of Loxa, Don Juan Lopez de Canizares, who is said to have d of fever in 1630.

years later, the wife of the viceroy of Peru, Luis Geronimo z de Cabrera y Bobadilla, fourth count of Chinchon, having icked with fever, the same corregidor of Loxa sent a packet red bark to her physician Juan de Vega, assuring him of its n the treatment of "*tertiana*." The drug fully bore out its repud the countess Ana was cured.[6] Upon her recovery, she caused ected large quantities of the bark, which she used to give away sick of fever, so that the medicine came to be called *Polvo de la* i.e. *The Countess' Powder*. It was certainly known in Spain wing year (1639), when it was first tried at Alcala de Henares rid.[7]

ntroduction of Peruvian Bark into Europe is described by Chifflet, to the archduke Leopold of Austria, viceroy of the Netherlands rundy, in his *Pulvis Febrifugus Orbis Americani ventilatus*, at Brussels in 1653. He says that among the wonders of the y reckon the tree growing in the kingdom of Peru, which the call *Palo de Calenturas*, i.e. *Lignum febrium*. Its virtues iefly in the bark, which is known as *China febris*, and which powder drives off the febrile paroxysms. He further states, ng the last few years the bark has been imported into Spain,

Hsch. naturf. Freunde zu Berlin 67) 60.

Chile, Peru, etc. ii. (1836) 222.

ook — *East India Chinchona* 74 75.

in *Peru and India*, 1862. 2.

by Weddell in his *Hist. des* p. 15, from De Jussieu's unpub-

The town of Loxa or Loja was he Spaniards in 1546.

umstances are fully narrated by La Condamine (*Mém. de l'Acad. royale des Sciences*, année 1738). But the cure of the countess was known in Europe much before this, for it is mentioned by Sebastiano Bado in his *Anastasis, Corticis Peruviæ, seu Chinæ Chinæ defensio*, published at Genoa in 1663. When Bado wrote, it was a debated question whether the bark was introduced to Europe by the count of Chinchon or by the Jesuit Fathers.

[7] Villerobel, quoted by Bado, *op. cit.* 202.

and thence sent to Cardinal Joannes de Lugo[1] at Rome. Chifflet that it has been carried from Italy to Belgium by the Jesuit Fa going to the election of a general, but that it was also brought th direct from Peru by Michael Belga, who had resided some yea Lima.

Chifflet, though candidly admitting the efficacy of the new when properly used, was not a strong advocate for it; and his publi started an acrimonious controversy, in which Honoratius Faber, a (1655), Fonseca physician to Pope Innocent X., Sebastiano Ba Genoa (1656 and 1663), and Sturm (1659) appeared in defence febrifuge; while Plempius (1655), Glantz an imperial physic Ratisbon (1653), Godoy physician to the king of Spain (1653), Moreau (1655), Arbinet and others contended in an opposite sense

From one of these disputants, Roland Sturm, a doctor of Lo who wrote in 1659,[3] we learn that four years previously, some new febrifuge had been sent by the archduke Leopold to the S ambassador at the Hague, and that he (Sturm) had been requi report upon it. He further states, that the medicine was kno Brussels and Antwerp, as *Pulvis Jesuiticus*, because the Jesuit I were in the habit of administering it gratis to indigent persons su from quartan fever; but that it was more commonly called *Pulvi anus* or *Peruvianum Febrifugum*, while at Rome it bore the n *Pulvis eminentissimi Cardinalis de Lugo*, because Cardinal de Lug to give it away to the poor:—that it was very scarce:—that in 1 saw 20 doses sent to Paris which cost 60 florins. He gives a the handbill[4] which the apothecaries of Rome used to distribut the powder.

The drug began to be known in England about 1655.[5] The *Me Politicus*, one of the earliest English newspapers, contains in sev its numbers for 1658,[6] a year remarkable for the prevalence in E of an epidemic remittent fever, advertisements offering for sale *excellent powder known by the name of the Jesuits' Powder*"—l over by James Thompson, merchant of Antwerp.

Brady, professor of physic at Cambridge, prescribed bark abo

[1] The cardinal belonged to a family of Seville, which town had the monopoly of the trade with America.

[2] Bado in his *Anastasis*, lib. 3, quotes the opinion of many persons as coinciding with his own.

[3] *Febrifugi Peruviani Vindiciarum pars prior—Pulveris Historiam complectens ejusque vires et proprietates . . . exhibens*, Delphis, 1659. 12°.

[4] It is in these words:—*Modo di adoprare la Corteccia chiamata della Febre.*—Questa Corteccia si porta dal Regno di Peru, e si chiama China, o vero China della febre, laquale si adopra per le febre quartana, e terzana, che venga con freddo: s'adopra in questo modo, cioè:

Se ne piglia dramme due, e si pista fina, con passarla per setaccio; e tre hore prima incirca, che debba venir la febre si mette in infusione in un bicchiero di vino bianco gagliardissimo, e quando il freddo comincia à venire, ò si sente qualche principio, si prende tutta la presa p e si mette il patiente in letto.

Avertasi, si potrà dare detta Cor modo sudetto nella febre terzana quella sia fermata in stato di molti

L'esperienza continua, hà liber tutti quelli, che l'hanno presa, prima bene il corpo, e per quat doppo non pigliar niuna sorte di mento, ma auvertasi di non darla licenza delli Sig. Medici, acciò giu sia in tempo à proposito di pigliari

[5] So says Sir G. Baker, who has t introduction of Cinchona in a very s published in the *Medical Transact* College of Physicians of London, 141-216.

[6] Namely No. 422. June 24-Jul 426. July 22-29; No. 439. Oct. 21 545. Dec. 9-16.—We have exa copy at the British Museum.

ı 1660, Willis, a physician of great eminence, reported it as daily use.

hose who contributed powerfully to the diffusion of the new as Robert Talbor *alias* Tabor. This singular personage apprenticed to an apothecary of Cambridge, settled in Essex actised medicine with much success. He afterwards came and in 1672 published a small book called *Pyretologia, a unt of the cause and cure of agues* (London, 12°). In this no means intimates that his method of cure depends on the . On the contrary, he cautions his readers against the ffects of Jesuits' Powder, when administered by unskilful admits that properly given, it is a "noble and safe medicine." reputation increasing, he was appointed in 1678, physician to Charles II.,[1] and on 27 July of the same year, received f knighthood at Whitehall. But he was not a member of f Physicians; and to save him from attack, the king caused written restraining that body from interfering with him in practice.[2] The following year, the king being ill of tertian ıdsor, Talbor cured him by his secret remedy.[3]

year Talbor visited France and Spain [4]; and in the former the good fortune to cure the Dauphin of an attack of fever, eated with success other eminent persons.[5] These happy ght him into favour with Louis XIV., who induced him in ı of a sum of 2,000 louis d'or and an annual pension of 2,000 plain his mode of treatment, which proved to consist in the n of considerable doses of cinchona bark infused in wine.[6] id not long enjoy his prosperity, for he died in 1681, aged ırs.[7] Upon his death, Louis XIV. ordered the publication of hod of cure, which accordingly appeared in 1682 in a small Nicolas de Blegny, surgeon to the king.[8] This was im-

tment made in consideration l acceptable services per- the issuing of a patent Seal, dated 7 August, 1678, Robert Talbor, an annuity of m, together with the profits ppertaining to a physician in sovereign.

—The physicians both in ance were exceedingly jealous of an irregular practitioner l averse to admit the merits

Yet D'Aquin, first phy- s XIV., prescribed *Vin de* well as powdered bark, for 6.—*See* J. A. le Roi, *Journal roi Louis XIV.*, Paris, 1862.

nouvelles etc. pendant l'année 466. This includes the *ce*, 23 Sept. 1679. In the following year (p. 275), the have had another attack of r, for which he took "*du ıre*," which again cured him. to the latter country was ite of the young queen of Orléans, niece of Louis XIV., escribed as *premier médecin*.

During Talbor's absence, his practice in London was carried on by his brother, Dr. John Talbor, as is proved by an advertisement in the *True News or Mercurius Anglicus*, January 7-10, 1679.

[5] *Lettres de Madame de Sérigné*, nouv. éd. tome v. (1862) 559; also tome vi., letters of 15 and 29 Sept. and 6 Oct. 1679.

[6] *Les admirables qualitez du Kinkina confirmées par plusieurs expériences*, Paris, 1689. 12°.

[7] He was buried in Trinity Church, Cambridge, where a monumental inscription describes him as—"*Febrium malleus*"—and physician to Charles II., Louis XIV., and the Dauphin of France. In Talbor's will, proved by his widow Dame Elizabeth, 18 Nov. 1681, and preserved at Doctors' Commons, mention is made of an only son, Philip Louis.

[8] *Le Remède anglois pour la guérison des fièvres, publié par ordre du Roy, avec les observations de Monsieur le premier Médecin de sa Majesté, sur la composition, les vertus, et l'usage de ce remède*, par Nicolas de Blegny, Chirurgien ordinaire du corps de Monsieur, et Directeur de l'Academie des nouvelles découvertes de Médecine, Paris, 1682. 12°.

mediately translated into English, under the title of *The English R or, Talbor's Wonderful Secret for Curcing of Agues and Feavers.—i the Author Sir Robert Talbor to the most Christian King, and si Death, ordered by his Majesty to be published in French, for the be his subjects, and now translated into English for Publick Good* (Lond.

Cinchona bark was now accepted into the domain of regular me though its efficacy was by no means universally acknowledged. appeared in the London Pharmacopœia in 1677, under the m *Cortex Peruanus.*

For the first accurate information on the botany of Cinchona, is indebted to the French.[1]

Charles-Marie de la Condamine, while occupied in commo Bouguer and Godin, as an astronomer from 1736 to 1743, in me the arc of a degree near Quito, availed himself of the opportu investigate the origin of the famous Peruvian Bark. On the 3 4th of February, 1737, he visited the Sierra de Cajanuma, 2½ from Loxa, and there collected specimens of the tree now kn *Cinchona officinalis* var. *a. Condaminea.* At that period, the ver trees had already become rare, but there were still specimens trunks thicker than a man's body. Cajanuma was the home of t cinchona bark brought to Europe; and in early times it enjoyed reputation, that certificates drawn up before a notary were provi proof that parcels of bark were the produce of that favoured loc

Joseph de Jussieu, botanist to the French expedition with wl Condamine was connected, gathered, near Loxa in 1739, a *Cinchona* subsequently named by Vahl, *C. pubescens,* a species medicinal value.

In 1742, Linnæus established the genus *Cinchona,*[3] and i first described the species *C. officinalis,* recently restored and characterised by Hooker, aided by specimens supplied to him Howard.

The cinchona trees were believed to be confined to the region Loxa, until 1752 when Miguel de Santisteban, superintendent mint at Santa Fé, discovered some species in the neighbourl Popayan and Pasto.

In 1761, José Celestino Mutis, physician to the Marquis de l viceroy of New Granada, arrived at Carthagena from Cad immediately set about collecting materials for writing a *Flora* country. This undertaking he carried on with untiring especially from the year 1782 until the end of his life in 1 first for seven years at Real del Sapo and Mariquita at the the Cordillera de Quindiu, and subsequently at Santa Fé de

[1] *Sur l'arbre de Quinquina* par M. de la Condamine—*Mém. de l'Académie royale des Sciences pour l'année* 1738. pp. 226–243, with two plates.

[2] This classic spot in the history of Cinchona, was visited in September 1861 by Robert Cross, who succeeded in bringing therefrom an abundant supply of the seeds of *C. officinalis* var. *Condaminea,* which in February of the year following, germinated freely at Ootacamund in India.

[3] Markham has vigorously conte the Linnæan name *Cinchona* sl altered to *Chinchona* as more in a with the derivation of the wer better commemorating the servi countess of Chinchon. But th venience of changing so well-esta name and its many derivatives, weighed these considerations; Markham's proposal has not r general acceptance either by botani maceutists or chemists.

tis gave up his medical appointment in 1772, for the purpose of ering a religious order, and ten years later was entrusted by the vernment with the establishment and direction of a large museum of ural history, first at Mariquita, afterwards at Santa Fé.

A position similar to that of Mutis in New Granada, had also been ferred in 1777 on the botanists Hipolito Ruiz and José Pavon with ard to Southern Peru, whence originated the well-known *Flora uviana et Chilensis*,[1] as well as most important direct contributions our knowledge on the subject of Cinchona.

About the same time (1776), Renquizo (Renquifo or Renjifo) found chona trees in the neighbourhood of Huanuco, in the central tract of u, whereby the monopoly of the district of Loxa was soon broken up. Numerous and important quinological discoveries were subsequently le by Mutis, or rather by his pupils Caldas, Zea, and Restrepo,[2] as l as on the other hand by Ruiz and Pavon, and their successors lla and Manzanilla. Mutis did not bring his labours to any definite clusion, and his extensive botanical collections and 5,000 coloured wings, were sent to Madrid only in 1817, and there remained in a entable state of neglect.

Some of his observations first appeared in print in 1793–94, under title of *El Arcano de la Quina* in the *Diario*, a local paper of Santa Fé, were reprinted at Madrid in 1828 by Don Manuel Hernandez de gorio. The botanical descriptions of the cinchonas of New Granada, ing the fourth part of the *Arcano*, remained forgotten and lost to ice until rescued by Markham and published in 1867.[3] The drawings nging to the descriptions were photographed and engraved a little , and form part of Triana's *Nouvelles Etudes sur les Quinquinas*, ch appeared in 1870.

The two Peruvian botanists succeeded somewhat better in securing results. Ruiz in 1792, in his *Quinologia*,[4] and in 1801 conjointly Pavon in a supplement thereto,[5] brought together a portion of their ortant labours relating to cinchona. But an essential part called *a Quinologia*, written between 1821 and 1826, remained unpublished; after an oblivion of over thirty years, it came by purchase into the s of Mr. John Eliot Howard who published it, and with rare ality enriched it with 27 magnificent coloured plates, mostly taken the very specimens of Pavon lying in the herbarium of Madrid.

Between the pupils of Mutis on the one hand, and those of Ruiz and on on the other, there arose an acrimonious controversy regarding respective discoveries, which has been equitably summarized by na in the work just mentioned.

Production—The hardships of bark-collecting in the primeval ts of South America are of the severest kind, and undergone only e half-civilized Indians and people of mixed race, in the pay of ilators or companies located in the towns. Those who are engaged

blished at Madrid, 1798-1802, in 4 es folio, with 425 plates.

. . Mutis n'avait qu'une notion in- et confuse du genre *Cinchona* et de tables caractères; c'est en définitive une de ses espèces, dans le sens strict , n'a été reconnue ni découverte par Triana, *Nouv. Etudes*, p. 8.

[3] Markham, *Chinchona Species of New Granada*, Lond. 1867.

[4] *Quinologia, ó tratado del árbol de la Quina ó Cascarilla*, Madrid, 1792. 4°. pp. 103.

[5] *Supplemento á la Quinologia*, Madrid, 1801. 4°. pp. 154.

in the business, especially the collectors themselves, are called *Cas-rilleros* or *Cascadores*, from the Spanish word *Cascara*, bark. A majo domo at the head of the collectors, directs the proceedings of the seven bands in the forest itself, where provisions and afterwards the produ are stowed away in huts of slight construction.

Arrot in 1736, and Weddell and Karsten in our own day, have give from personal observation, a striking picture of these operations.

The cascarillero having found his tree, has usually to free its ste from the luxuriant climbing and parasitic plants with which it is e circled. This done, he begins in most cases at once to remove after previous beating, the sapless layer of outer bark. In order to detach t valuable inner bark, longitudinal and transverse incisions are made high as can be reached on the stem. The tree is then felled, and t peeling completed. In most cases, but especially if previously beat the bark separates easily from the wood. In many localities it has be dried by a fire made on the floor of a hut, the bark being placed hurdles above,—a most imperfect arrangement. In Southern Peru Bolivia however, according to Weddell, even the thickest Calisaya b is dried in the sun without requiring the aid of fire.

The thinner bark as it dries, rolls up into tubes or quills ca *canutos* or *canutillos*, while the pieces stripped from the trunks are m to dry flat by being placed one upon another and loaded with weig and are then known as *plancha* or *tabla*. The bark of the root formerly neglected, but is now in several instances brought into market.

After drying, the barks are either assorted, chiefly according size, or all are packed without distinction in sacks or bales. In s places, as at Popayan, the bark is even *stamped*, in order to reduce bulk as much as possible. The dealers in the export towns enclose bark in *serons*[1] of raw bullock-hide, which, contracting as it dries, tig compresses the contents (100 lb. or more) of the package. In m places however, wooden chests are used for the packing of bark.

Conveyance to the Coast and Commercial Statistics—ports to which bark is conveyed for shipment to Europe, are not numerous.

Guayaquil on the Pacific coast is the most important for the pro of Ecuador. The quantity shipped thence in 1871 was 7,859 quint Pitayo bark is largely exported from Buenaventura in the Bay of C further north.

Payta the most northerly port of Peru, and Callao the port of l likewise export bark, the latter being the natural outlet for the bar Central Peru from Huanuco to Cusco.

Islay, and more particularly Arica, receive the valuable bark Carabaya and of the high valleys of Bolivia. The barks of Peru Bolivia now find an outlet also by the Amazon and its tributaries are shipped to Europe from ports of Brazil. Howard[3] has give interesting account of one of the first attempts to utilize this ea route, made by Senr. Pedro Rada in 1868.

There is a large export of the barks of New Granada, princi

[1] From *zurrón*, the Spanish name for a pouch or game-bag.

[2] *Consular Reports*, presented to l ment, July 1872.

[3] Seemann's *Journ. of Bot.* vi. (186

m Santa Marta, whence the shipments[1] in 1871 were 3,415,149 lb.; d in 1872, 2,758,991 lb. From the neighbouring port of Savanilla which presents the city of Barranquilla, the sea-terminus of the navigation the Magdalena, the export of bark in 1871 was 1,043,835 lb., value 8,715.[2] Some Cinchona bark is also shipped from Venezuela by way Puerto Cabello.

The quantity of bark appearing in the *Annual Statement of Trade*, "Peruvian Bark," imported into the United Kingdom in 1872, was ,451 cwt., valued at £285,620; of which, 11,843 cwt. was shipped m New Granada, 4,668 cwt. from Ecuador, and 5,829 cwt. from Peru, remainder being entered as from the ports of Chili, Brazil, Central nerica and other countries.

Cultivation—The reckless system of bark-cutting in the forests of ith America, which has resulted in the utter extermination of the tree m many localities, has aroused the attention of the Old World, and at length prompted serious efforts to cultivate the tree on a large le in other countries.

The idea of cultivating Cinchonas out of their native regions was anced by Ruiz in 1792, and by Fée of Strassburg in 1824.[3] Royle[4] nted out in 1839, that suitable localities for the purpose might be nd in the Neilgherry Hills and probably in many other parts of India, argued indefatigably in favour of the introduction of the tree.

The subject was also urged in reference to Java in 1837 by Fritze, ctor of medical affairs in that island; in 1846 by Miquel, and sequently by other Dutch botanists and chemists.[5]

Living Cinchonas had been taken to Algeria as early as 1849, by the rvention of the Jesuits of Cusco, but their cultivation met with no ess.

Weddell in 1848, brought cinchona seeds from South America to nce, and strenuously insisted on the importance of cultivating the t. His seeds, especially those of *C. Calisaya*, germinated at the lin des Plantes in Paris, and in June 1850, living seedlings were sent lgeria; and in April 1852, through the Dutch Government, to Java.

The first important attempts at cinchona-cultivation were made by Dutch. Under the auspices of the Colonial Minister Pahud, after- ls Governor-General of the Dutch East Indies, the botanist Hasskarl despatched to Peru for the purpose of obtaining seeds and plants. mission was so far successful, that a collection of plants contained 1 Wardian cases, was shipped in August 1854 from Callao, in a te sent expressly to receive them. Notwithstanding every care, plants did not reach Java in good condition; and when Hasskarl ned his appointment in 1856, he bequeathed to his successor ghuhn, only 167 young cinchonas, though 400 specimens had been ed from South America.

An impulse to the project of cinchona-planting was given in 1852 oyle, in a report addressed to the East India Company, in which he ed out, that the Government of India were then spending more than

[1] *ular Reports*, August 1873. 743.
[2] d. August 1872.
[3] *urs d'Hist. nat. pharmaceutique*, ii. 252

[4] *Illustrations of the Bot. of the Himalayan Mountains*, i. (1839) 240.

[5] According to Van Gorkom, suggestions to the same end were made to the Dutch Government as early as 1829 by Reinwardt.

£7,000 a year for Cinchona bark, in addition to about £25,00 quinine.[1]

After some unsatisfactory endeavours on the part of the I Government to obtain plants and seeds through the interventi H. M. Consuls in South America, Mr. Clements Robert Markham o his services, which were accepted. Mr. Markham, though not a pro botanist, was well qualified for the task by a previous acquaintance the country and people of Peru and Bolivia, and by a knowledge o Spanish and Quichua languages,—and even more so by a rare a of zeal, intelligence, and forethought. Being fully aware of the culties of the undertaking, he earnestly insisted that nothing sho neglected which could ensure success; and in particular made re demands for a steam-vessel to convey the young plants across the I to India, which unfortunately were not complied with. He further the desirableness of not confining operations to a single district, but deavouring to procure by different collectors all the more valuable s

The prudence of this latter suggestion was evident, and Ma was enabled to engage the services of Richard Spruce, the distingu botanist, then resident in Ecuador, who expressed his readin undertake a search for the Red Bark trees (*C. succirubra*) in the of Chimborazo. He also secured the co-operation of G. J. Pritch the neighbourhood of Huanuco, and of two skilful gardeners, John and Robert Cross. The last-named was employed in 1861 to p seeds of *C. officinalis* from the Sierra de Cajanuma near Loxa, 1863–64 those of *C. Pitayensis* from the province of Pitayo in Ec

Markham reserved for himself the border-lands of Peru and B in order to obtain *C. Calisaya;* and for this purpose started from in March 1860. Arriving in the middle of April by way of Ar and Puno, at Crucero, the capital of the province of Carabaya, he his way to the village of Sandia, near which he met with the first mens of *Cinchona* in the form of the shrubby variety of *C. Ca* termed *Josephiana.* He afterwards found the better variety *a. re* also *C. ovata* R. et P., *C. micrantha* R. et P., and *C. pubescens* Vah these sorts, but chiefly of the first three, 456 plants were ship Islay in June 1860.

In consequence of the hostile attitude of the people, and the je of the Bolivian Government, lest an important monopoly sho broken up, added to the difficulties arising from insalubrious c and the want of roads, the obstacles encountered by Markham very great, and no attempt could be made to wait for the ripe the seeds of the Calisaya, which takes place in the month of Aug

The expedition of Spruce was successful, but was also attende much difficulty and danger, of which there are vivid pictures

[1] In 1870, the Indian Government purchased no less than 81,600 ounces of sulphate of quinine, besides 8,832 ounces of the sulphates of cinchonine, cinchonidine and quinidine. The quantities bought in subsequent years have been much smaller until the present year (1874).

[2] *Report on the Expedition to procure seeds of C. Condaminea* [1862]; also *Report to the Under Secretary of State for Indi Pitayo Chinchona*, by Robt. Cross, 1

[3] Great difficulty was at first exper successfully conveying living Cinch to India, even in Wardian cases; an lections formed by Hasskarl, Markh Pritchett almost all perished after their destination (Markham's letter, 1861). But the propagation by proved very rapid.

ıg narratives by himself and by Cross, published in the Par-
ry Returns of 1863 and 1866.[1]
service entrusted to Pritchett was also efficiently performed;
ıceeded in bringing to Southampton, six cases containing plants
rantha and *C. nitida*, besides a large supply of seeds.
important supplies of plants and seed for British India have
been obtained from the Dutch plantations in Java. Seeds of
dia, the tree affording the valuable bark of New Granada, were
through Dr. Karsten.
e of an excellent variety of *C. Calisaya*, obtained in the Bolivian
of Caupolican in 1865 by Mr. Charles Ledger,[2] have afforded
ich in Java have yielded bark of extraordinary goodness. It
ıle that this variety will henceforth be very largely cultivated,
y in the Dutch plantations.
iously to the arrival in India of the first consignment of plants,
nquiries were instituted from a meteorological and geological
view, as to the localities most adapted for the cultivation. This
in the selection for the first trial, of certain spots among the
ry (or Nilgiri) Hills on the south-west coast of India and in the
Presidency. Of this district, the chief town is Ootacamund (or
ınd), situated about 60 miles south of Mysore and the same
from the Indian Ocean. Here the first plantation was esta-
n a woody ravine, 7,000 feet above the sea-level, a spot pro-
by Mr. Markham to be exceedingly analogous, as respects
n and climate, to the Cinchona valleys of Carabaya. Other
ns were formed in the same neighbourhood, and so rapid was
ıagation, that in September 1866, there were more than 1½
of Cinchona plants on the Neilgherry Hills alone.[3] The species
rs best there is *C. officinalis*.
number was stated to be in 1872, 2,639,285, not counting the
ırivate planters. The largest are about 30 feet high, with trunks
et in girth. The area of the Government plantations on the
ry Hills is 950 acres.[4]
ations have also been made in the coffee-producing districts of
and in Coorg, Travancore and Tinnevelly, in all instances we
ıs private speculations.
ıona plantations have been established by the Government of
the valleys of the Himalaya in British Sikkim,[5] and some have
rted in the same region by private enterprise. In the former
re on the 31 March, 1870, more than 1½ millions of plants
ıtly placed, the species growing best being *C. succirubra* and
ya. The Cinchona plantation of Rungbi near Darjiling (British
covered in 1872, 2,000 acres. In the Kangra valley of the
Himalaya, plantations have been commenced, as well as in the
Presidency, and in British Burma.

*ondence relating to the introduc-
Chinchona Plant into India*,
the House of Commons to be
March, 1863 and 18 June, 1866.
Journ., July 12, 1873. 25.
Book (Chinchona Cultivation)
—A name that must always be
in connection with the Neil-
ntations, is that of William Graham McIvor, who by his rare practical skill and sagacity in the cultivation and management of the tree, has rendered most signal services in its propagation in India.

[4] *Moral and material progress and condition of India during* 1871-72, presented to Parliament 1873. p. 33.

[5] The first annual Report dates from 1862 to 1863.

Ceylon offers favourable spots for the cultivation of Cinchona, i mountain region which occupies the centre of the island, as at galle near Neuera-Ellia, 5,000 feet above the sea, where a plantatio formed by Government in 1861. The production of bark has been up with spirit by the coffee-planters of Ceylon.

The Government of India has acted with the greatest libera distributing plants and seeds of Cinchona, and in promoting the c tion of the tree among the people of India;[1] and it has freely g supplies of seed to other countries.

The plantations of Java commenced by Hasskarl, increased Junghuhn's management to such an extent, that in December 186 were 1,360,000 seedlings and young trees, among which howev more valuable species, as *C. Calisaya, C. lancifolia, C. micrant C. succirubra,* were by far the least numerous, whereas *C. Pahud* which the utility was by no means well established, amounted t a million. The disproportionate multiplication of this last was due to it quickly yielding an abundance of seeds, and to its ra vigorous growth. Another defect in the early Dutch system of c tion arose from the notion that the Cinchona requires to be grown shade of other trees, and to a less successful plan of multiply cuttings and layers.

These and other matters were the source of animated and ofte discussions, which terminated on the one hand by the death of Ju in 1864, and on the other by the skilful investigations of De Vry.

This eminent chemist was despatched by the Government of I in 1857 to Java, that he might devote his chemical knowledge investigation of the natural productions of the island, includi then newly introduced Cinchona. In connexion with the lat Vry did not confine his attention to Java, but visited the pla of Ceylon and Ootacamund, thereby gathering information th utilized to the best advantage. In fact under K. W. van Gorko was appointed superintendent in 1864, the Dutch plantation assumed a very prosperous state. They are now rich in *C. C* which thrives there better than *C. officinalis;* while the propag *C. Pahudiana* has been abandoned since the year 1862.[2]

The history of the transplantation of the Cinchona has bee the subject of an exhaustive report laid before the *Société d'Ac tion* of France, by Delondre and Soubeiran,[3] in which are recor attempts that have been made to introduce the tree into Brazil, the West Indies, and even into the warmer parts of Europe.

Cinchona Bark from the Indian plantations began to be brou the London market in 1867,[4] and now arrives in constantly inc quantities.

Description—(A). *Of Cinchona Barks generally.*—In the d ment of their bark, the various species of Cinchona exhibit cons

[1] Up to January 1870, more than 178,000 plants had been distributed from the Neilgherry plantations to private individuals.

[2] Yet the plantations are maintained, and the bark, which is of good appearance, is brought in some quantity into the European market. Though poor in alkaloids, it is rich in cincho-tannic acid.

[3] *De l'introduction et de l'acclimatation des Cinchonas dans les Indes néerl anglaises,* Paris 1868.

[4] When I was in London, in Au I went to Finsbury Place, to Spruce, and was happy enough to also Mr. Howard, who presented myself with market samples of th portation of *C. succirubra,* from plantation, Ootacamund.—F. A. F

Many are distinguished from an early stage by an abundant
n of the outer surface, while in others this takes place to a
gree, or only as the bark becomes old. The external appearance
rks varies therefore very much, by reason of the greater or less
ent of the suberous coat. The barks of young stems and
have a greyish tint more or less intense, while the outer bark
ood displays the more characteristic shades of brown or red,
after removal of the corky layers.

living bark, these colours are very pale, and only acquire their
by exposure to the air, and drying. Some of them however are
stic of individual species, or at least of certain groups, so that
ctions originated by the bark-collectors of *pale, yellow, red,* &c.[1]
ted by druggists, are not without reason.

xture, the barks vary in an important manner by reason of
in anatomical structure. Their fracture especially, depends
number, size and arrangement of the liber fibres, as will be
our description of their microscopic characters.

aste in all species is bitter and disagreeable, and in some there
lition a decided astringency. Most species have no marked
least in the dried state. But this is not the case in that of *C.*
, the smell of which is characteristic.

Of the Barks used in pharmacy.—For pharmaceutical prepara-
istinguished from the pure alkaloids and their salts, the Cinchona
ployed are chiefly of three kinds.

le Cinchona Bark, Loxa Bark, Crown Bark.[2]—This bark, which
to the use of quinine and for long afterwards was the ordinary
Bark of English medicine, is only found in the form of quills,
occasionally as much as a foot in length, but are more often
w inches or are reduced to still smaller fragments. The quills
¾ down to ⅛ of an inch in diameter, often double, and variously
and shrunken. The thinnest bark is scarcely stouter than
aper; the thickest may be $\frac{1}{10}$ of an inch or more.[3] The pieces
blackish brown or dark greyish external surface, variously
with silver-grey, and often beset with large and beautiful
The surface of some of the quills is longitudinally wrinkled
rately smooth; but in the majority it is distinctly marked by
e cracks, and is rough and harsh to the touch. The inner side
striated and of a bright yellowish brown.

bark breaks easily with a fracture which exhibits very short
the inner side. It has a well-marked odour *sui generis*, and an
t bitter taste. Though chiefly afforded by *C. officinalis*, some
cies occasionally contribute to furnish the Loxa Bark of com-
shown in the conspectus at p. 318.

lisaya Bark, Yellow Cinchona Bark.[4]—This bark, which is the
portant of those commonly used in medicine, is found in flat

llowing are common terms in re-
the barks of Peru:—*Amarilla*
lanca (white), *colorada* or *roja*
ajada (orange), *negrilla* (brown).
Cinchona pallida; F. *Quinquina*
Loxachina. The term *Crown*
riginally restricted to a superior
a Bark, shipped for the use of
mily of Spain.

[3] In the old collections of the Royal College of Physicians, there are specimens of very thick Loxa Bark, of a quality quite unknown there at the present day. They are doubtless the produce of ancient trees, such as were noticed by La Condamine.

[4] *Cortex Cinchonæ flavæ, Cortex Chinæ regius*; F. *Quinquina Calisaya*; G. *Königschina*.

pieces (*α.*), and in quills (*β.*), both afforded by *C. Calisaya* Wedd., though usually imported separately.

α. Flat Calisaya—is in irregular flat pieces, a foot or more in length by 3 to 4 inches wide, but usually smaller, and $\frac{2}{10}$ to $\frac{4}{10}$ of an inch in thickness; devoid of suberous layer and consisting almost solely of liber, of uniform texture, compact, and ponderous. Its colour is a rusty orange-brown, with darker stains on the outer surface. The latter is roughened with shallow longitudinal depressions, sometimes called *digital furrows.*[1] The inner side has a wavy, close, fibrous texture. The bark breaks transversely with a fibrous fracture; the fibres of the broken ends are very short, easily detached, and with a lens are seen to be many of them faintly yellowish and translucent.

A well-marked variety known as *Bolivian Calisaya*, is distinguished for its greater thinness, closer texture, and for containing numerous laticiferous ducts which are wanting in common flat Calisaya bark.

β. Quill Calisaya—is found in tubes $\frac{3}{4}$ to $1\frac{1}{2}$ inch thick, often rolled up at both edges, thus forming double quills. They are always coated with a thick, rugged, corky layer, marked with deep longitudinal and transverse cracks, the edges of which are somewhat elevated. This suberous coat which is silvery white or greyish, is easily detached, leaving its impression on the cinnamon-brown middle layer. The inner side is dark brown and finely fibrous. The transverse fracture is fibrous but very short. The same bark also occurs in quills of very small size, and is then not distinguishable with certainty from Loxa bark.

3. *Red Cinchona Bark.*—Though still retaining a place in the British Pharmacopœia, this is by far the least important of the Cinchona barks employed in pharmacy. But as the tree yielding it (*C. succirubra*), is now being cultivated on a large scale in India, the bark may probably come more freely into use.

Red Bark of large stems, which is the most esteemed kind, occurs in the form of flat or channelled pieces, sometimes as much as $\frac{1}{2}$ an inch in thickness, coated with their suberous envelope which is rugged and warty. Its outermost layer in the young bark has a silvery appearance. The inner surface is close and fibrous and of a brick-red hue. The bark breaks with a short fibrous fracture.[2]

Some very fine Red Bark recently imported from Ceylon (1873), in stout channelled or quilled pieces 20 inches long, internally of a reddish brown. It is stated to be rich in alkaloids, two-fifths of which are quinine and quinidine; and has been sold in London at a high price.

(C). *Of the Barks not used in pharmacy.*—Among the non-officinal barks, the most important are afforded by *Cinchona lancifolia* Mutis and *C. Pitayensis* Wedd., natives of the Cordilleras of Columbia.

These barks are largely imported and used for making quinine, the former under the names of *Columbian, Carthagena*, or *Caqueta bark.* It varies much in appearance, but is generally of an orange-brown: the corky coat, which scales off easily, is shining and whitish. The barks of *C. lancifolia* often occur in fine large quills or thick flattened pieces. Their anatomical structure agrees in all the varieties which we have examined, in the remarkable number of thick-walled and tangential

[1] From the notion that they resemble the marks left by drawing the fingers over wet clay.

[2] Thick Red Bark that happens to have a very deep and brilliant tint, is eagerly bought at a high price for the Paris market.

ells of the middle cortical layer and the medullary rays. In
of alkaloids, Carthagena barks are liable to great variation.
itayo Barks are restricted to the south-western districts of
and are usually imported in short flattish fragments, or
ills, of brownish rather than orange colour, mostly covered
ll greyish or internally reddish cork. The middle cortical
its but few thick-walled cells; the liber is traversed by very
llary rays, and is provided with but a small number of widely
liber fibres, which are rather thinner than in most other
barks. The Pitayo barks are usually rich in alkaloids, quinine
Cinchona Pitayensis is one of the hardiest species of the
inchonas, and is therefore particularly suitable for cultivation,
rever has not yet been carried out as largely as that of either
is or *C. succirubra.*
Conspectus on the next page, we have arranged the principal
Cinchona, with short indications of the barks which some of
d.[2]

scopic Structure—The first examination of the minute
of Cinchona barks is due to Weddell, whose observations have
ded in one of his beautiful plates published in 1849.[3] Since
numerous other observers have laboured in the same field of

l Characters.—These barks as contrasted with those of other
not exhibit any great peculiarities of structure; and their
nay be comprehended in the following statements. The
in the anatomical sense, occurs only in the youngest barks,
not found in commerce. The *corky layer* which replaces the
is constructed of the usual tabular cells. In some species as
a, it separates easily, at least in the older bark, whereas in
C. succirubra, the bark even of trunks is always coated with it.
species the corky tissue is not only found on the surface, but
t occur also in the inner substance of the bark. In this case
ns of tissue external to the inner corky layers or bands, are
as *bork-scales* (*periderm* of Weddell). This peculiar form of
issue[4] was first examined (not in cinchona) in 1845 by H. von
called it *rhytidoma* (*Borke* of the Germans). In *C. Calisaya* it
ant occurrence, but not so in *C. succirubra* and some others; the
therefore affords a good means of distinguishing several barks.
nner portion of the bark exhibits a *middle* or *primary layer*
um).[5] made up of parenchyme; and a second inner layer or *liber*
um)[6] displaying a much more complicated structure. The
ayer disappears if rhytidoma is formed: barks in which this is
are therefore at last exclusively composed of liber, of which
aya Bark is a good example.
iber is traversed by *medullary rays*, which in cinchona are

s an Indian village eastward of
map of the country between
ogotá in Blue Book (East India
lant) 1866. 257.
ies included by Weddell in his
ur les Quinquinas, namely *C.*
Wedd. and *C.* (?) *Barbacoensis*
been omitted, as not in our
nging to the genus.

[3] *Hist. nat. des Quinquinas*, tab. ii.
[4] Fluckiger, *Grundlagen*, Berlin, 1872. 61. fig. 48.
[5] *Enveloppe ou tunique cellulaire* of Weddell; *Mittelrinde* of the Germans.
[6] In German *Bast*, or *Phloëm* of modern German botany.

CONSPECTUS OF THE PRINCIPAL SPECIES O F CINCHONA.

SPECIES (EXCLUDING SUB-SPECIES AND VARIETIES) ACCORDING TO WEDDELL.	WHERE FIGURED.	NATIVE COUNTRY.	WHERE CULTIVATED.	PRODUCT.
I. Stirps Cinchonæ officinalis				
1. Cinchona officinalis Hook. . .	Bot. Mag. 5364 . .	Ecuador (Loxa).	India, Ceylon, Java.	Loxa or Crown Bark, Pale Bark.
2. ,, macrocalyx Pav. . .	Howard N. Q. . .	Peru	. . . . .	Ashy Crown Bark. The sub-species *C. Palton* affords an important sort called *Palton Bark* much used in the manufacture of quinine.
3. ,, lucumæfolia Pav. . .	Do. . .	Ecuador, Peru		
4. ,, lanceolata R. et P. (?).	Do. . .	Peru	. . . . .	Carthagena Bark, confounded with Palton Bark, but is not so good.
5. ,, lancifolia Mutis . . .	Karst. tab. 11. 12. .	New Granada .	India.	Columbian Bark. Imported in immense quantities for manufacture of quinine. The soft Columbian Bark is produced by Howard's var. *oblonga*.
6. ,, amygdalifolia Wedd. .	Wedd. tab. 6. . .	Peru, Bolivia .	. . . . .	A poor bark, not now imported.
II. Stirps Cinchonæ rugosæ				
7. Cinchona Pitayensis Wedd. . .	Karst. tab. 22. (C. *Triaur*). . . .	New Granada (Popayan) .	India	Pitayo Bark. Very valuable; used by makers of quinine; it is the chief source of quinidine.
8. ,, rugosa Pav.	Howard N. Q. . .	Peru.	. . . . .	Bark unknown, probably valueless.
9. ,, Mutisii Lamb. . . .	Do. . .	Ecuador . . .	. . . . .	Bark not in commerce, contains only aricine.
10. ,, hirsuta R. et P. . . .	Wedd. tab. 21. . .	Peru		
11. ,, Carabayensis Wedd .	Wedd. tab. 19. . .	Peru, Bolivia .	. . . . .	Bark not collected.
12. ,, Pahudiana How. . .	Howard N. Q. . .	Peru	India, Java. . .	A poor bark, yet of handsome appearance; propagation of tree discontinued.
13. ,, asperifolia Wedd . .	Wedd. tab. 20. . .	Bolivia . . .	. . . . .	Bark not collected.
14. ,, umbellulifera Pav. . .	Howard N. Q. . .	Peru	. . . . .	Bark not known as a distinct sort.
15. ,, glandulifera R. et P. .	Do. . .	Peru	. . . . .	Do.
16. ,, Humboldtiana Lamb. .	Do. . .	Peru	. . . . .	False Loxa Bark, Jaen Bark. A very bad bark.
III. Stirps Cinchonæ micranthæ				
17. Cinchona australis Wedd . . .	Wedd. tab. 8. . .	South Bolivia	. . . . .	An inferior bark, mixed with Calisaya.
18. ,, scrobiculata H et B. .	Do. . .	Peru	. . . . .	Bark formerly known as *Red Cusco Bark* or *Santa Ana Bark*.
19 ,, Peruviana How. . .	Howard N. Q. . .	Peru	India	Grey Bark, Huanuco or Lima Bark. Chiefly consumed on the Continent.
20. ,, nitida R. et P. . . .	Do. . .	Peru	India	
21. ,, micrantha R. et P. . .	Do. . .	Peru	India	
IV. Stirps Cinchonæ Calisayæ				
22. Cinchona Calisaya Wedd. . . .	Wedd. tab. 9. . .	Peru, Bolivia .	India, Ceylon, Java, Jamaica, Mexico.	Calisaya Bark, Bolivian Bark, Yellow Bark. The tree exists under many varieties, bark also very variable.
23. ,, elliptica Wedd. . . .	. . . . .	Peru (Carabaya)	. . . . .	Carabaya Bark. Bark scarcely now imported. *C. cuneura* Miq. (flower and fruit unknown) may perhaps be this species.
V. Stirps Cinchonæ ovatæ				
24. Cinchona purpurea R et P. . .	Howard, N. Q. . .	Peru (Huamalies)	. . . . .	Huamalies Bark. Not now imported.
25. ,, rufinervis Wedd. . .	Do. . .	Peru, Bolivia .	. . . . .	Bark, a kind of light Calisaya.
26. ,, succirubra Pav. . .	Do. . .	Ecuador . . .	India, Ceylon, Java, Jamaica.	Red Bark. Largely cultivated in British India.
27. ,, ovata R et P . . .	Do. . .	Peru, Bolivia .	India (?), Java ?).	Inferior Brown and Grey Barks.
28 ,, cordifolia Mutis	Karst. tab. 8	New Granada,	. . . . .	Columbian Bark (in part). Tree exists under many varieties; bark of some used in manufacture of quinine.

tly very obvious, and project more or less distinctly into the middle ical tissue. The liber is separated by the medullary rays into lges,[1] which are constituted of a parenchymatous part and of yellow orange fibres. The number, colour, shape, and size, but chiefly the angement of these fibres, confer a certain character common to all the ks of the group under consideration.

The liber-fibres[2] are elongated and bluntly pointed at their ends but er branched, mostly spindle-shaped, straight or slightly curved, and not eeding in length 3 millimetres. They are consequently of a simpler icture than the analogous cells of most other officinal barks. y are about ¼ to ⅓ mm. thick, their transverse section exting a quadrangular rather than a circular outline. Their walls are ngly thickened by numerous secondary deposits, the cavity being iced to a narrow cleft, a structure which explains the brittleness of fibres. The liber-fibres are either irregularly scattered in the liber-, or they form radial lines transversely intersected by narrow strips arenchyme, or they are densely packed in short bundles. It is a liarity of cinchona barks that these bundles consist always of a few s (3 to 5 or 7), whereas in many other barks (as cinnamon), analogous lles are made up of a large number of fibres. Barks provided with bundles of the latter kind, acquire therefrom a very fibrous fracture, st cinchona barks from their short and simple fibres, exhibit a short ure. It is rather granular in Calisaya bark, in which the fibres are st isolated by parenchymatous tissue. In the bark of *C. scrobiculata*, newhat short fibrous fracture[3] is due to the arrangement of the fibres adial rows. In *C. pubescens*, the fibres are in short bundles and ace a rather woody fracture.

esides the liber-fibres, there are some other cells contributing to the liarity of individual cinchona barks. This applies chiefly to the *ferous ducts* or *vessels*[4] which are found in many sorts; they are ered through the tissue intervening between the middle cortical layer the liber, and consist of soft, elongated, unbranched cells, mostly ding in diameter the neighbouring parenchymatous cells.

s to the *contents of the tissue* of cinchona barks, crystallized alkaloids not undoubtedly visible. Howard has published figures represent-minute rounded aggregations of crystalline matter in the cells, which upposes to be kinates of the alkaloids; and also distinct acicular als which he holds to be of the same nature. These remarkable arances are easily observable, yet only after sections of the bark been boiled for a minute in weak caustic alkali and then washed water; it may well be doubted whether they are strictly natural.

he greater number of the parenchymatous cells are loaded with starch granules, or in young and fresh barks with chlorophyll. veral barks, as in that of *C. lancifolia* Mutis, numerous cells of middle cortical layer and even of the medullary rays, are provided somewhat thick walls, and contain either a soft brown mass ystalline oxalate of calcium. These cells have therefore been *resin-cells* and *crystal-cells*; they are mostly isolated, not forming

...strahlen or *Phloëmstrahlen* of the ...

...res corticales of Weddell; *Baströhren ...llen* in German.

[3] *Fracture filandreuse*, Weddell; *fadiger Bruch* of the Germans.

[4] *Vaisseaux laticifères* of Weddell; *Milchsaftschläuche* in German.

extensive groups or zones, and their walls are not strongly thicken in true sclerenchymatous tissue. If thin sections of the bark moistened with dilute alcoholic perchloride of iron, the walls of the except the fibres and the cork, assume a blackish-green due to c tannic acid; this applies even to the starch granules.

Characters of particular sorts.—The modifications of general str just described, are sufficient to impart a special character to the of many species of Cinchona, provided the bark is examined at i development, the structural peculiarities being far from well-m in young barks.

Thus, it is not possible to point out any distinctive features f *Loxa Bark* of commerce, because it is mostly taken from young We may say of it, that neither resin-cells nor crystal-cells occur middle layer, that its laticiferous vessels become soon obliterate have indeed disappeared in the older quills; and that the liber form interrupted, not very regular, radial rows.

The quills of *C. Calisaya* display large laticiferous ducts, whi wanting in the flat bark. There is a peculiar sort of the latter *Bolivian Calisaya* (already mentioned at p. 316), the flat pieces of still possess very obvious laticiferous vessels. As to the liber-fil Calisaya bark, they are as before stated (p. 319), scattered thro the parenchymatous tissue or endophlœum. In the bark of *C. ac lata*, which might at first sight be confounded with Calisaya ba liber-fibres form radial, less interrupted rows. The microscope therefore the means of distinguishing these two barks.

The barks of *C. succirubra* are particularly rich in laticiferous mostly of considerable diameter, in which the formation of new chyme may not unfrequently be observed. The orange liber occurring in this bark are less numerous, more scattered, and of s size than in Calisaya. The fracture of Red Bark, especially the fl is therefore more finely granular and not so coarse as that of Cali

The structural characters of Cinchona barks may lastly be fully ciated by examining barks of the allied genera *Buena*, *Cascarilla* an *enbergia*, which were formerly known under the name of *False Ci Barks*. The microscope shows that the liber-fibres of the lat soft, branched and long, densely packed into large bundles, im therefore a well-marked fibrous structure. The external appear these barks is widely different from that of true cinchona barks of them it would appear is now collected for the purpose of adulte

Chemical Composition—The most important and at the sam peculiar principles of Cinchona bark are the *Alkaloids*,—enumer the following table:—

Cinchonine	$C^{20}H^{24}N^{2}$
Cinchonidine (*Quinidine* of many writers) . .	same for
Quinine	$C^{20}H^{24}N^{2}$
Quinidine (*Conquinine* of Hesse) . . .	same for
Quinamine	$C^{20}H^{26}N$

Gomes[1] of Lisbon first succeeded in obtaining active princi cinchona, by treating an alcoholic extract of the bark with water,

[1] Ensaio sobre o Cinchonino, e sobre sua influencia na virtude da quina e d'outras cascas.—*Mem. da Acad. R. das Sc Lisboa*, iii. (1812) 202-217.

›lution caustic potash, and crystallizing the precipitate from The basic properties of the substance thus obtained, which alled *Cinchonino*, were observed in the laboratory of Thénard ›u-Labillardière, and communicated to Pelletier and Caventou.[1] ›efore that time, Sertürner had asserted the existence of organic ınd the French chemists guided by that brilliant discovery, ›bled to show that the *Cinchonino* of Gomes belonged to the ss of substances. Pelletier and Caventou however, speedily ›ut that it consisted of two distinct alkaloids, one of which ›ed *Quinine*, the other *Cinchonine*.

onidine (thus called by Pasteur) was first obtained and charac- ›nder the name of *Quinidine* in 1847, by F. L. Winckler of lt, from Maracaibo Bark (*C. Tucujensis* Karst.); and in 1852 it e closely studied in Liebig's laboratory by Leers, still under the *quinidine*.

idine is the name applied in 1833 by Henry and Delondre to an ›hey obtained from the bark called *Quinquina Carthagène rosé* ıfforded by Howard's *Cinchona rosulenta*, a tree which Weddell s a sub-species of *C. succirubra*. The peculiar nature of quini- not clearly proved until 1853, when Pasteur examined it and ts identity with the *Beta-quinine* extracted in 1849 by Van ›n from commercial quinoidin.[2] The name *quinidine* having ›e applied to different basic substances more or less pure, Hesse ›sed to replace it by that of *Conquinine*, which however has not general acceptance. The alkaloid is especially characteristic of o barks.

ımine was discovered in 1872 by Hesse, in bark of *C. succirubra* l at Darjiling in British Sikkim.

ine is another basic substance discovered in 1845 by Winckler, ırk of *Buena hexandra* Pohl. Hesse detected it along with ›e in the bark of *C. succirubra*; its composition is not yet

names *Aricine*, *Cinchovatine*, *Cusconine*,[3] have been given to obtained from certain barks of inferior value, especially that of ›ns var. *Pelletieriana*, which has not been imported for several The composition and properties of these substances remain

ine was pointed out by Peretti (1837), but Hesse has shown ıat the bark called *China bicolorata*, *Tecamez*[4] or *Pitoya Bark* ch it was obtained, is altogether destitute of alkaloid.

›ating for a length of time solutions of the cinchona alkaloids ›xcess of some mineral acid, Pasteur (1853) obtained amorphous ions of the natural bases. Quinine thus afforded *Quinicine*,

›e *Chim. et de Phys.* xv. (1820) ›ntity of the original *quinidine* ınd Delondre with that studied rs later by Pasteur though not many chemists, is nevertheless ble of actual proof, no specimen ›f the original substance existing ›on.

Gmelin, *Chemistry*, xvii. (1866) 568; Husemann, *Pflanzenstoffe*, 1870. 346. 349. 350. It is almost certain that *cinchoretine* is identical with *cinchonidine*.

[4] So called from Tecamez or Tacames, a small port of Ecuador in about lat. 1° N. The bark which was first noticed in Lambert's *Description of the Genus Cinchona*, 1797. 30. tab. ii., is of unkpown botanical origin. See also Guibourt, *Hist. des Drogues*, iii. (1869) 190 (Quinquina bicolore).

having the same composition; cinchonine and cinchonidine furnish *Cinchonicine*, likewise agreeing in composition with the alkaloids fr which it originates. These amorphous products may also be obtai by heating the natural bases in glycerin at 200° C., when a red substa is also formed. In quinine manufactories, amorphous alkaloids constantly met with, being partly produced in the course of the m pulations to which the materials are subjected. Yet cinchona b also afford *amorphous alkaloids* at the very outset of analysis, whe we must infer their existence in the living plant.

Lastly may be mentioned *Paytine*, $C^{21}H^{24}N^2O + H^2O$, a crystallin alkaloid discovered in 1870 by Hesse in a white bark of uncertain orig It is allied to quinamine and quinidine, but has not been met wit any known cinchona bark.

The name *Quinoidine* (or rather "*Chinioïdin*") was applied by S türner (1829) to an uncrystallizable basic substance, which he prep from cinchona barks and thought to be a peculiar alkaloid. The t has subsequently been bestowed upon a preparation which has found way into commerce and medical practice, in the form of a dark br brittle extractiform mass, softening below 100° C., and having usual slight alkaline reaction. It is obtained in quinine factories by cipitating the brown mother-liquors with ammonia, and consists ch of the amorphous alkaloids just mentioned. Recently it has been p fied by a process not yet made public, and can be obtained as a sulp or hydrochlorate in the form of a slightly coloured powder.

The alkaloids under consideration have not been met with in appreciable amount in other parts of the cinchonas than the bark, has their presence been ascertained in other plants than those of tribe *Cinchoneæ*.

Characters of the Cinchona Alkaloids.

1. *Quinine.*—It is obtained from alcoholic solutions, in prisms o composition $C^{20}H^{24}N^2O^2 + 3\,H^2O$, fusing at 57° C. The crystals m deprived of water by warming or exposure over oil of vitriol, and fuse at 177° C. The anhydrous alkaloid is likewise crystallizabl requires about 21 parts of ether for solution, but dissolves more re in chloroform or absolute alcohol. These solutions deviate the r polarized light to the left, and so do likewise solutions of the sa quinine. Yet one and the same quantity of alkaloid exhibits a different rotatory power according to the solvent used, though the vo of the solution remain the same. Even the common sulphate diffe this respect from the two other sulphates of quinine. The same re applies to the optical power of the other alkaloids.

If ten volumes of a solution of quinine, or of one of its salts mixed in a test tube with one volume of chlorine water, and a dr ammonia is added, a brilliant green colour makes its appearance solutions rich in quinine, a green precipitate, *Thalleioquin* or *Dalle* is produced; in solutions containing less than $\frac{1}{1000}$ of quinine, no cipitate is formed, but the fluid assumes a green even more beautiful in a stronger solution. The test succeeds with a solution conta

[1] Flückiger in *Neues Jahrb. für Pharm.* xxxv. (1871) 291; Wiggers and Hus *Jahresbericht* for 1872. 132.

ly one part of quinine in 5000; and in a solution containing not ore than $\frac{1}{20000}$ of quinine, if bromine is used instead of chlorine.[1]

The bitter taste of quinine is not appreciable in solutions containing s than one part in 100,000. The blue fluorescence displayed by a lution of quinine in dilute sulphuric acid, is observable in solutions ntaining much less than one part in 200,000 of water; yet it is not parent in very strong solutions.

Besides the *common medicinal* sulphate, $2\,C^{20}H^{24}N^2O^2 + SH^2O^4 + 8H^2O$, inine forms two other crystallizable sulphates, namely, the so-called *utral* or *soluble* sulphate of pharmacy, $C^{20}H^{24}N^2O^2 + SH^2O^4 + 7H^2O$, d a third having the composition, $C^{20}H^{24}N^2O^2 + 2\,SH^2O^4 + 7H^2O$.

Herapath showed in 1852 that quinine forms with sulphuric acid and line a peculiar compound, *Iodo-sulphate of Quinine*, having the comsition $4\,(C^{20}H^{24}N^2O^2) + 3\,(H^2SO^4) + 6\,I + 3\,H^2O$. As this substance sesses optical properties analogous to those of tourmaline, it was lled by Haidinger, *Herapathite*. It may be easily obtained by disving sulphate of quinine in 10 parts of weak spirit of wine conning 5 per cent. of sulphuric acid, and adding an alcoholic solution of line until a black precipitate is no longer formed. This precipitate is lected on a filter and washed with alcohol; then dissolved in boiling rit of wine and allowed to crystallize. The tabular crystals thus tained, are extremely remarkable on account of their dichroïsm and larizing power, as well as for their sparing solubility, since they require 00 parts of boiling water for solution; the latter property may be lized for separating quinine from the other cinchona alkaloids and imating its quantity.

2. *Quinidine* (*Conquinine* of Hesse)—forms crystals having the comition, $C^{20}H^{24}N^2O^2 + 2H^2O$; the anhydrous alkaloid melts at 168° C., l requires about 30 parts of ether for solution. Its solutions are ngly dextrogyre; it agrees with quinine as regards bitterness, rescence and the thalleioquin test, and forms a neutral and an acid phate. The most striking character of quinidine is afforded by its riodate, the crystals of which require for solution at 15° C., 1250 s of water or 110 parts of alcohol sp. gr. ·834. Quinidine may efore be separated from the other alkaloids of bark, by a solution of de of potassium which will precipitate the hydriodate. According lesse (1873), quinidine is further characterized by the fact that its hate is soluble in 20 parts of chloroform at 15° C., the sulphates of other cinchona-alkaloids being far less soluble in that liquid. The mon medicinal sulphate of quinine, *e.g.*, requires for solution 1000 s of chloroform.

3. *Cinchonine*.—This alkaloid forms crystals which are always ydrous: they fuse at 257° C., and require about 400 parts of ether 120 of spirit of wine for solution. Cinchonine further differs from ine by its dextrogyre power, its want of fluorescence, and its nonptibility to the thalleioquin test. Its hydriodate is readily soluble ater, and still more so in alcohol whether dilute or strong.

4. *Cinchonidine*—forms anhydrous crystals melting at 206° C., soluble 6 parts of ether, or 20 of spirit of wine, then affording levogyre

[1] *Pharm. Journ.*, May 11, 1872. 901.

liquids, devoid of fluorescence,[1] and not acquiring a green colour (thalle quin) by means of chlorine water and ammonia. Hydrochlorate cinchonidine forms pyramidal crystals of the monoclinic system, w different from the hydrochlorates of the allied alkaloids.

5. *Quinamine.*—The crystals are anhydrous, fuse at 172° C., and fo at a temp. of 20°, with 32 parts of ether or 100 parts of spirit of wi a dextrogyre solution. Quinamine is even to some extent soluble boiling water, and abundantly in boiling ether, benzol, or petrole ether. The solutions of quinamine do not stand the thalleioquin t nor do they display fluorescence; in acid solution, the alkaloid is lia to be transformed into an amorphous state. Quinamine moistened w concentrated nitric acid, assumes like paytine, a yellow coloration. hydriodate is readily soluble in boiling water, but very sparingly in c water, especially in presence of iodide of potassium, in which respec is allied to quinidine as well as to paytine.

The more important properties of the Cinchona-alkaloids may summarized as follows:—

a. *Hydrated* crystals are formed by . . .	Quinine, Quinidine, (Paytine).
No hydrated crystals by	Cinchonine, Cinchonidine, Quinamine.
b. *Abundantly* soluble in ether	Quinine, Quinidine, Quinamine, (Paytin and the amorphous alkaloids.
Sparingly soluble in ether	Cinchonidine.
Almost insoluble in ether	Cinchonine.
c. *Levogyre* solutions afforded by	Quinidine, Cinchonidine, (Paytine).
Dextrogyre solutions by	Cinchonine, Quinidine, Quinamine, a the amorphous alkaloids.
d. Thalleioquin is formed by	Quinine, Quinidine, and also by Quinic
Thalleioquin cannot be obtained from .	Cinchonine, Cinchonidine, Quinamine, a from Cinchonicine.
e. Fluorescence is displayed by solutions of	Quinine, Quinidine.
No fluorescence in solutions of pure . .	Cinchonine, Cinchonidine, Quinamine.

Proportion of Alkaloids in Cinchona Barks—This is liable very great variation. We know from the experiments of Hesse (18 that the bark of *C. pubescens* Vahl is sometimes devoid of alkal Similar observations made near Bogota upon *C. Pitayensis* Wedd, *corymbosa* Karst., and *C. lancifolia* Mutis, are due to Karsten. He ma tained[3] that barks of one district were sometimes devoid of quin while those of the same species from a neighbouring locality, yiel $3\frac{1}{2}$ to $4\frac{1}{2}$ per cent. of sulphate of quinine.

Another striking example is furnished by De Vry[4] in his examina of quills of *C. officinalis* grown at Ootacamund, which he found to in percentage of alkaloids, from 11·96 (of which 9·1 per cent. quinine) down to less than 1 per cent.

Among the innumerable published analyses of cinchona bark, t are a great number showing but a very small percentage of the a principles, of which quinine, the most valuable of all, is not se altogether wanting. The highest yield on the other hand hith

[1] De Vry maintains that cinchonidine is not *totally devoid* of fluorescence.

[2] *Berichte der Deutschen chem. Gesellsch.*, Berlin, 1871. 818.

[3] *Die med. Chinarinden Neu-Gran* 17. 20. 39.

[4] *Pharm. Journ.* Sept. 6, 1873. 181.

; obtained by Broughton[1] from a bark grown at Ootacamund. orded not less than 13½ per cent. of alkaloids, among which predominant.

facts just mentioned, show that it is impossible to state even y any constant percentage of alkaloids in any given bark. wever say that good *Flat Calisaya Bark*, as offered in the r pharmaceutical preparations, contains at least 5 to 6 per ine.

orn or *Lora Bark*, the *Cortex Cinchonæ pallidæ* of pharmacy, : to say the least very uncertain. On its first introduction century, when it was taken from the trunks and large full-grown trees, it was doubtless an excellent medicinal he same cannot be said of much of that now found in hich is to a large extent collected from very young wood.[2] Crown Bark produced in India is however of extraordinary ; shown by the recent experiments of De Vry.[3]

d Bark, the thick flat sort contains only 3 to 4 per cent. but a large amount of colouring matter. The quill Red Indian plantations is a much better drug, some of it) 10 per cent. of alkaloids, more than a third of which is a fourth cinchonidine, the remainder being cinchonine and

tion in the amount of alkaloids relates not merely to their ıge, but also to the proportion which one bears to another. cinchonine are of the most frequent occurrence; cinchoni- sual, while quinidine is still less frequently met with and ge amount. The experiments performed in India[4] have rn, that external influences contribute in an important ıe formation of this or that alkaloid; and it may even be he cultivators of cinchona will discover methods of pro- ormation of quinine and of reducing, if not of excluding, ess valuable alkaloids.

nciples of Cinchona Barks—Count Claude de la Garaye[5] 46) a crystalline salt deposited in extract of cinchona bark, ras known for some time in France as *Sel essentiel de la* rmbstädt at Berlin (1785) showed it to be a salt of calcium, y of whose acid was pointed out in 1790 by C. A. Hoffmann,[6] ry of Leer in Hanover, who termed it *Chinasäure*. The of this substance, which is the *Kinic Acid* of English s ascertained by Liebig to be $C^7H^{12}O^6$. The acid forms crystals, fusible at 161° C., of a strong and pure acid taste, o parts of water, also in spirit of wine, but hardly in ether. ; are levogyre. Kinic acid appears to be present in every also to occur in barks of allied genera; and in fact to be wide distribution in the vegetable kingdom.[7] By heating , interesting derivatives are obtained; thus, by means of per- ganese and sulphuric acid, we get yellow crystals of *Kinone*

— "*East India Cinchona* 2: *Yearbook of Pharmacy*,

's analyses and observations, xiv. (1855) 61–63.

[3] *Pharm. Journ.* Sept. 6, 1873. 184.
[4] Blue Book, 1870. 116. 188. 205.
[5] *Chimie hydraulique*, Paris, 1746. 114.
[6] Crell's *Chem. Annalen*, 1790, ii. 314-317.
[7] Gmelin, *Chemistry*, xvi. (1864) 222.

or *Quinone*, $C^6H^4O^2$,—a reaction which may be used for ascertainin presence of kinic acid. Kinic acid is devoid of any noteworthy ph logical action.

Cincho-tannic Acid—is precipitated from a decoction of bark by a of lead, after the decoction has been freed from cinchona-red by me magnesia. The cincho-tannate of lead decomposed by sulphu hydrogen, and the solution cautiously evaporated *in vacuo*, yield acid as an amorphous, hygroscopic substance, readily soluble in alcohol, or ether. The solutions, especially in presence of an alka quickly decomposed, a red flocculent matter, *Cinchona-red*, being duced. Solutions of cincho-tannic acid assume a greenish colo addition of a ferric salt. By destructive distillation, cincho-tannic affords pyrocatechin.

Quinovic (or *Chinovic*) *Acid*, $C^{24}H^{38}O^4$, crystallizes in hex scales which are tasteless, sparingly soluble in cold alcohol, more in boiling alcohol, but not dissolved by water, ether, or chlorofor occurs in cinchona barks, and has been met with by Rembold (18 the rhizome of *Potentilla Tormentilla* Sibth.

Other Constituents of Cinchona Barks—Quinovic acid is a panied by *Quinovin* (or *Chinovin*), $C^{30}H^{48}O^8$, an amorphous bitte stance, first obtained (1821) by Pelletier and Caventou under the of *Kinic Acid*, from *China nova*[1] in which it occurs combined with Quinovin in alcoholic solution, was shown in 1859 by Hlasiwetz, resolved by means of hydrochloric gas into quinovic acid, $C^{24}H^{38}O$ an uncrystallizable sugar, *Mannitan*, $C^6H^{12}O^5$, with subtraction of The formation of quinovic acid takes place more easily, if quino placed in contact with sodium amalgam and spirit of wine, whe 12 hours, mannitan and quinovate of sodium are formed (Rochleder,

Quinovin, although an indifferent substance, may be remove cinchona barks by weak caustic soda, from which it is precipita hydrochloric acid, together with quinovic acid and cinchona-red. of lime then dissolves quinovin and quinovic acid, but not t substance. Quinovic acid and quinovin again precipitated by a may be separated by chloroform in which the latter only is soluble

Quinovin dissolves in boiling water, and more abundantly in s wine; its solutions, as well as those of quinovic acid, are dext Quinovin seems to be a constant constituent of almost every part cinchonas and the allied *Cinchoneæ*, although the amount of it in does not apparently exceed 2 per cent. It is accompanied by qu acid: both substances are stated to have tonic properties.

Cinchona-red, an amorphous substance to which the red cinchona barks is due, is produced as shown by Rembold (1867), cincho-tannic acid is boiled with dilute sulphuric acid, sugar formed at the same time. By fusing cinchona-red with potash, catechuic acid, $C^7H^6O^4$, is produced. Cinchona-red is sparingly in alcohol, abundantly in alkaline solutions, but neither in water ether. Thick Red Bark in which it is abundant, affords it to the of over 10 per cent.

The Cinchona barks yield but a scanty percentage of as

[1] The bark of *Bucna magnifolia* Wedd., a tree with fragrant flowers and magnificent foliage, yielding a worthless bark which used to appear occasionally in the market.

eding 3 per cent., a fact well according with the small amount they tain of oxalate of calcium.

Estimation of the Alkaloids in Cinchona Bark—The microscope ll enable us, as already shown, to ascertain whether a given bark is rived from *Cinchona*, but it can furnish no exact information as to the tual value of such bark as a drug.

Yet there is a very simple test by which the presence of a cinchona-aloid may be demonstrated. These alkaloids heated in a glass tube the presence of a volatile acid or of substances capable of producing volatile acid, evolve heavy vapours of a beautiful crimson colour. ery bark, even the smallest fragment, containing traces of a cinchona-aloid affords these red vapours, as was shown in 1858 by Grahe of an. On the other hand the reaction fails with all other barks, and n with true cinchona barks which are destitute of alkaloid.

But to ascertain the real value of a cinchona bark, a quantitative mation of the alkaloids is necessary. A good process for this opera- has lately been given by De Vry.[1] It is as follows:—Mix 20 nmes of powdered bark, dried at 100° C., with milk of lime (5 grm. ed lime to 50 grm. water), dry the mixture slowly, and then boil it h 200 cubic centimetres of strong alcohol. Pour the liquid on to a ll filter, and afterwards the residual bark and lime mixed with 100 .cent. more alcohol. Wash the powder on the filter with 100 cub. cent. pirit. From the mixed liquids, now nearly 400 cub. cent., separate sulphate of calcium by a few drops of weak sulphuric acid. Filter, ill off the spirit and pour into a capsule the residual liquid,—to which the distilled spirit and the water with which the distilling apparatus been rinsed out. Let the capsule be now heated on a water-bath il all the spirit shall have been expelled; and let the remaining liquor ch contains all the alkaloids in the form of acid sulphates, be filtered. re will remain on the filter quinovic acid and fatty substances, which t be washed with slightly acidulated water. The filtrate and washings ced to about 50 cub. cent., should be treated while still warm with tic soda in slight excess.[2] The precipitate should be washed with smallest quantity of water, pressed between folds of blotting paper. oved therefrom and dried. The weight multiplied by 5 will indicate percentage of *mixed* alkaloids in the bark.

To separate the alkaloids from each other, treat the powdered mass ten times its weight of ether. This will resolve it into two portions.) *insoluble in ether*, (b) *soluble in ether*.

a). This should be converted into neutral sulphates, and to the tion there should be added iodide of potassium, which will separate *idine*. After removal of the latter (if present), add solution of tar- of potassium and sodium, which will throw down in a crystalline tartrate of *cinchonidine*; from the mother-liquor, *cinchonine* may recipitated by caustic soda.

b). The ether having been evaporated, the residue is to be dissolved n times its weight of weak spirit of wine (0·915) at 15° C., to which

[1] *Pharm. Journ.*, Sept. 27, 1873, 241.

[2] De Vry has recently pointed out that ed filtrate may contain a little quinovic r an allied substance, accompanying aloids. To get rid of this, he would precipitate the latter with a good excess of caustic lye, decanting it off from the precipitate, and then add water to the latter before throwing it on to a filter.

dilute sulphuric acid ($\frac{1}{20}$ of the volume of the spirit) has been ad The solution should be filtered, gently warmed, and tincture of io added so long as herapathite (p. 323) is formed. Of this compo 100 parts dried at 100° C., contain 56·5 parts of *Quinine.*

After adding a few drops of sulphurous acid, the alcohol should be evaporated from the fluid from which the crystals of herapathite l been removed, and caustic lye added, by which the amorphous alkal will be precipitated, including *quinamine* if present.

Uses—Cinchona bark enjoys the reputation of being a most valu remedy in fevers. But the uncertainty of its composition and its convenient bulk render it a far less eligible form of medicine than alkaloids themselves. It is nevertheless much used as a general to in various pharmaceutical preparations.

As to the alkaloids, the only one which is in general use is *quin* The neglect of the others is a regrettable waste, which the result of re investigations ought to obviate. In the year 1866, the Madras Gov ment appointed a Medical Commission to test the respective efficac the treatment of fever, of Quinine, Quinidine, Cinchonine and C chonidine. Of the sulphates of these alkaloids, a due supply, speci prepared under Mr. Howard's superintendence, was placed at the posal of the Commission. From the report[1] it appears that the num of cases of paroxysmal malarious fevers treated, was 2472,—nam 846 with Quinine, 664 with Quinidine, 569 with Cinchonine, and with Cinchonidine. Of these 2472 cases, 2445 were cured, and 27 fai The difference in remedial value of the four alkaloids, as deduced f these experiments, may be thus stated:—

Quinidine—ratio of failure per 1000 cases treated				6
Quinine	,,	,,	,,	7
Cinchonidine	,,	,,	,,	10
Cinchonine	,,	,,	,,	23

The Indian Government, acting on the recommendation of Howard, has officially advised (Dec. 16, 1873) the more free use in I of cinchona alkaloids other than quinine, and especially of *sulpha cinchonidine,* which is procurable in abundance from Red Bark.[2] nidine on the other hand, which has proved the most valuable of a only obtainable from a few barks and in very limited amount.

Adulteration—There is not now any frequent importation of *spu* cinchona barks, but the substitution of bad varieties for good is suffici common. To discriminate these in a positive manner by ascerta the percentage of quinine, which is the chief criterion of value, rec must be had to chemical analysis, a method of performing which been described.

Modern Works relating to Cinchona.

The following enumeration has been drawn up for the sake of desiring more ample information than is contained in the fore pages, but it has no pretension to be a complete list of all publica that have lately appeared on the subject.

[1] Blue Book—*East India Chinchona Cultivation,* 1870. pp. 156-172.—The report contains very interesting and important medical details. See also Dougall in *Edinb. Med. Journ.* Sept. 1873.

[2] We hear (April 1874) that the G ment has lately purchased by tend tween 300 and 400 lb. of cinchonidin

g (Otto), *Chinarinden der pharmakognostischen Sammlung zu Berlin.* Berlin, 1865, 4°. 48 pages and 10 plates showing the microscopic structure of barks.

gen (Heinrich von), *Monographie der China.* Hamburg, 1826, 4°. 348 pages and 7 coloured plates representing the following barks:—China rubra, Huanuco, Calisaya, flava, Huamalies, Loxa, Jaen. An exhaustive work for its period in every direction.

e-books—*East India (Chinchona Plant).* Folio.

. *Copy of Correspondence relating to the introduction of the Chinchona Plant into India, and to proceedings connected with its cultivation, from March* 1852 *to March* 1863. Ordered by the House of Commons to be printed, 20 March, 1863. 272 pages.

Contains correspondence of Royle, Markham, Spruce, Pritchett, Cross, McIvor, Anderson and others, illustrated by 5 maps.

. *Copy of further Correspondence relating to the introduction of the Chinchona Plant into India, and to proceedings connected with its cultivation, from April* 1863 *to April* 1866. Ordered by the House of Commons to be printed, 18 June, 1866. 379 pages.

Contains Monthly Reports of the plantations on the Neilgherry Hills; Annual Reports for 1863–64, 1864–65, with details of method of propagation and cultivation, barking, mossing, attacks of insects, illustrated by woodcuts and 4 plates; report of Cross's journey to Pitayo, with map; Cinchona cultivation in Wynaad, Coorg, the Pulney Hills and Travancore, with map; in British Sikkim, the Kangra Valley (Punjab), the Bombay Presidency, and Ceylon.

. *Copy of all Correspondence between the Secretary of State for India and the Governor-General, and the Governors of Madras and Bombay, relating to the cultivation of Chinchona Plants, from April* 1866 *to April* 1870. Ordered by the House of Commons to be printed, 9 August, 1870.

Contains reports on the Neilgherry and other plantations, with map; appointment of Mr. Broughton as analytical chemist, his reports and analyses; reports on the relative efficacy of the several cinchona alkaloids, on cinchona cultivation at Darjiling and in British Burma.

londre (Augustin Pierre) et Bouchardat (Apollinaire), *Quinologie.* Paris, 1854, 4°. 48 pages, and 23 good coloured plates exhibiting all the barks then met with in commerce.

kom (K. W. van), *Die Chinacultur auf Java.* Leipzig, 1869, 61 pages. An account of the management of the Dutch plantations.

rard (John Eliot), *Illustrations of the Nueva Quinologia of Pavon.* London, 1862, folio, 163 pages and 30 beautiful coloured plates.—Figures of Cinchona mostly taken from Pavon's specimens in the herbarium of Madrid, and 3 plates representing the structure of several barks.

rard (John Eliot), *Quinology of the East Indian Plantations.* London, 1869, folio x. and 43 pages, with 3 coloured plates exhibiting structural peculiarities of the barks of cultivated *Cinchonæ.*

sten (Hermann), *Die medicinischen Chinarinden Neu-Granada's.* Berlin, 1858, 8°. 71 pages, and 2 plates showing microscopic structure of a few barks. An English translation prepared under the supervision of Mr. Markham, has been printed by the India Office, under

the title of *Notes on the Medicinal Cinchona Barks of New Gran by H. Karsten*, 1861. The plates have not been reproduced.

Karsten (Hermann), *Floræ Columbiæ terrarumque adjacentium specim selecta.* Berolini, 1858, folio. Beautiful coloured figures of vari plants including Cinchona, under which name are several spec usually referred to other genera. Only the first 3 parts have be published.

Markham (Clements Robert), *The Chinchona Species of New Gran containing the botanical descriptions of the species examined Drs. Mutis and Karsten; with some account of those botanists, a of the results of their labours.* London, 1867, 8°. 139 pages a 5 plates. The plates are not coloured, yet are good reduced copies those contained in Karsten's *Floræ Columbiæ;* they represent t following:—*Cinchona corymbosa, C. Trianæ, C. lancifolia, C. on folia, C. Tucujensis.*

Miquel (Friedrich Anton Wilhelm), *De Cinchonæ speciebus quibusd adjectis iis quæ in Java coluntur. Commentatio ex Annalibus M Botanici Lugduno-Batavi exscripta.* Amstelodami, 1869, 4°. pages.

Phoebus (Philipp), *Die Delondre-Bouchardat'schen China-Rinden.* Gi sen, 1864, 8°. 75 pages and a table. The author gives a descript without figures, of the microscopic structure of the type-specim figured in Delondre and Bouchardat's *Quinologie.*

Planchon (Gustave), *Des Quinquinas.* Paris et Montpellier, 1864, 150 pages. A description of the cinchonas and their barks. English translation has been issued under the superintendence of Markham by the India Office, under the title of *Peruvian Bark Gustave Planchon.* London, printed by Eyre and Spottiswoode. 1

Soubeiran (J. Léon) et Delondre (Augustin), *De l'introduction e l'acclimatation des Cinchonas dans les Indes néerlandaises et dan Indes britanniques.* Paris, 1868, 8°. 165 pages.

Triana (José), *Nouvelles études sur les Quinquinas.* Paris, 1870. f 80 pages and 33 plates. An interesting account of the labou Mutis, illustrated by uncoloured copies of some of the draw prepared by him in illustration of his unpublished *Quinolog Bogotá,* especially of the several varieties of *Cinchona lancif* also an enumeration and short descriptions of all the specie *Cinchona,* and of New Granadian plants (chiefly *Cascarilla*) form placed in that genus.

Vogl (August), *Chinarinden des Wiener Grosshandels und der W Sammlungen.* Wien, 1867, 8°. 134 pages, no figures. A exhaustive description of the microscopic structure of the occurring in the Vienna market, or preserved in the museum that city.

Weddell (Hugh Algernon), *Histoire naturelle des Quinquinas, ou graphie du genre Cinchona, suivie d'une description du genr carilla et de quelques autres plantes de la même tribu.* Paris. folio, 108 pages, 33 plates, and map. Excellent uncoloured fi of Cinchona and some allied genera, and beautiful coloured draw of the officinal barks. Plate I. exhibits the anatomical structu the plant; Plate II. that of the bark.

Weddell (Hugh Algernon), *Notes sur les Quinquinas, extrait des An*

sweetish taste and abounds in sugar;[1] its decoction is not lue by iodine, nor is any starch to be detected by means of ope. The drug occasionally appears in the London market.

ll Striated Ipecacuanha—This drug in outward appearance mbles the preceding, but is usually of smaller size,—sometimes ler and in short pieces tapering towards either end. It also eing brittle, abounding in starch, and having its woody column ith numerous pores, easily visible under a lens. Prof. Planchon[2] ho has particularly examined both varieties of Striated Ipe- s of opinion that the drug under notice may be derived from s of *Richardsonia.*

ulated Ipecacuanha —The root thus called is that of *ia scabra* L., a plant of the same order as *Cephaëlis*, very Brazil, where it grows in cultivated ground and sandy places, ides, and even in the less frequented streets of Rio de Janeiro. specimens have been forwarded to us by Mr. Glaziou of Rio and Mr. J. Correa de Méllo of Campinas; and we have also le supply of the plant cultivated by one of us near London. t in the fresh state is pure white, but by drying becomes of n-grey. In the Brazilian specimens, there is a short crown s many as a dozen prostrate stems; below this there is s in true ipecacuanha, a naked woody portion, which extends into a thicker root, $\frac{2}{10}$ of an inch in diameter, and six or s long. This part of the root is marked by deep fissures on ides, which give it a knotty, sinuous, or undulating outline. ittle, very thick bark, white and farinaceous within, surround- g flexible slender woody column. The root has an earthy altogether unlike that of ipecacuanha, and a slightly sweet affords no evidence of emetine when tested in the manner t p. 335.

VALERIANACEÆ.

RADIX VALERIANÆ.

ian Root; F. *Racine de Valériane*; G. *Baldrianwurzel.*

cal Origin—*Valeriana officinalis* L., an herbaceous perennial ing throughout Europe from Spain to Iceland, the North Cape imea, and extending over Northern Asia to the coasts of Man- e plant is found in plains and uplands, ascending even in 1200 feet above the sea-level.

land, valerian is cultivated in many villages[3] near Chester- erbyshire, the wild plant which occurs in the neighbourhood ufficiently plentiful to supply the demand.

nont, New Hampshire and New York, as well as in Holland,

n *Pharm. Journ.* xi. (1870)

Pharm. xvi. (1872) 404; xvii.

ahover, Woolley Moor, Morton, Stretton, Higham, Shirland, Pilsley, North and South Wingfield, and Brackenfield. From the produce of these villages, one wholesale dealer in Chesterfield obtained in 1872 about 6 tons (13,440 lb.) of root.

the plant is grown to some extent. It is propagated by separating young plants which are developed at the end of runners emitted the rootstock.

The wild plant, according to the situation it inhabits, exhibits se divergent forms. Among eight or more varieties noticed by botan we may especially distinguish *α. major* with a comparatively tall and all the leaves toothed, and *β. minor* (*V. angustifolia* Tausch) entire or slightly dentate leaves.

History—The plant which the Greeks and Romans called Φ *Phu*, and which Dioscorides and Pliny describe as a sort of wild is usually held to be some species of valerian.[2]

The word *Valeriana* is not found in the classical authors. We meet with it in the 9th or 10th century, at which period and for afterwards, it was used as synonymous with *Phu* or *Fu*.

Thus in the writings of Isaac Judæus[3] an Egyptian physician, died at an advanced age, A.D. 932[4] occurs the following:—"*Fu* *valeriana, melior rubea et tenuis et quæ venit de Armenia et est dire sua complexione. . . .*"

Constantinus Africanus[5] who ended his life in 1087, as a mo Monte Casino where he taught medicine, says—"*Fu, id est vale Naturam habet sicut spica nardi. . . .*"

The word *Valeriane* occurs in the recipes of the Anglo-Saxon le written as early as the 11th century.[6] *Valeriana, Amantilla* and *I* used as synonymous in the *Alphita*, a mediæval vocabulary of the s of Salernum.[7]

Saladinus[8] of Ascoli in Italy, directs (*circa* A.D. 1450) the coll in the month of August of "*radices fu id est valerianæ.*"

Valerian was anciently called in English *Setwall*, a name pr applied to *Zedoary;* and the root was so much valued for its med virtues, that as Gerarde[9] (1567) remarks, the poorer classes in the of England esteemed "*no broths, pottage, or physicall meats*" to be anything without it. Its odour now considered intolerable, was regarded in the 16th century, when it was absolutely the custom the root among clothes as a perfume[10] in the same way as those of *riana Celtica* L. and the Himalayan valerians are still used in the

Some of the names applied to valerian in Northern and Central E are remarkable. Thus in Scandinavia we find *Velandsrot, Vela Vändelrot* (Swedish); *Vendelród, Venderód, Vendingsród* (Norwe and *Velandsurt* (Danish)—names all signifying *Vandals' root.*[11] V is also called in Danish *Danmarks gras.* Among the German-sp population of Switzerland, a similar word to the last, namely *Tan*

[1] Regel, *Tentamen Floræ Ussuriensis*, 1862 (*Mém. de l'Académie de St. Pétersbourg*).

[2] *V. officinalis* L. and nine other species, occur in Asia Minor (Tchihatcheff).

[3] *Opera Omnia*, Lugd. 1515, cap. 45.—It must be remembered that this is a translation from the Arabic. How the word in question stands in the original we have no means of knowing.

[4] Choulant, *Handb. der Bücherkunde für die ältere Medicin*, Leipz. 1841. 347.

[5] *De Omnibus medico cognitu necessariis*, Basil. 1539. 348.

[6] *Leechdoms, Wortcunning and of early England*, iii. (1866) 6. 138.

[7] S. de Renzi, *Collectio Salern.* (1854) 271-322.

[8] *Compendium Aromatariorum*, 1488.

[9] *Herball*, 1636, 1078.

[10] Turner's *Herball*, part 3 (1 Langham, *Garden of Health*, 1633.

[11] H. Jenssen-Tusch, *Nordiske Pl* Kjöbenhavn, 1867. 258.

›plied to valerian. The *Denemarcha* mentioned by St. Hildegard,[1] t A.D. 1160, is the same. These names seem to point to some con-on with Northern Europe which we are wholly unable to explain.

Description—The valerian root of the shops consists of an upright ›me of the thickness of the little finger, emitting a few short hori-al branches, besides numerous slender rootlets. The rhizome is rally very short, and is rendered still more so by the practice of ng it in order to facilitate drying. The rootlets which are gene-3 to 4 inches long, attain $\frac{1}{16}$ of an inch in diameter, tapering dividing into slender fibres towards their extremities. They are elled, very brittle, and, as well as the rhizome, of a dull, earthy n. When broken transversely, they display a dark epidermis ing part of a thick white bark which surrounds a slender woody nn. The interior of the rhizome is compact, firm and horny, but 1 old becomes hollow, a portion of the tissue remaining however in orm of transverse septa.

he drug has a peculiar, somewhat terebinthinous and camphor-like r, and a bitterish, aromatic taste. The root when just taken from round has no distinctive smell, but acquires its characteristic odour dries.

Microscopic Structure[2]—In the rhizome as well as in the rootlets, ortical part is separated from the central column by a dark cambial ; the medullary rays are not distinctly obvious. In old rootstocks, enchymatous cells are met with in the cortical tissue.

he parenchyme of the drug is loaded with small starch granules, nish grains of tannic matter and drops of essential oil.

Chemical Composition—Volatile oil is contained in the dry root e extent of ½ to 2 per cent. This variation in quantity is partly ined by the influence of locality, a dry, stony soil yielding a root r in oil than one that is moist and fertile. According to Zeller, the pears to be more abundant in autumn than in spring. But Schoon-t[3] has shown that the most important influence is the recent tion of the root. He states that if the root is submitted to distilla-while perfectly fresh, it yields a neutral water and a large quantity ential oil. The latter has but a very faint odour, but by exposure e air it slowly acidifies, especially if a little alkali is added, and res a strong smell. *Valerianic Acid* which is thus formed, amounts per mille of the fresh root. The dried root yields a distillate of ed valerian odour, containing valerianic acid, but in proportion not ling 4 per mille of the root calculated as fresh. Thus, by the ion of drying, the essential oil is oxidized in the root itself, and hes the acid and resinoid secondary products. Bouchardat[4] is of n that even the essential oil does not exist in the living plant, but t is formed by a reaction similar to that which takes place in the tion of oil of bitter almonds.

ces, Argent. 1533. 62.

structure of the rhizomes and roots ifferent species of valerian has re-en discussed by Joannes Chatin in es sur les Valérianées, Paris, 1872, d by 14 beautiful plates.

[3] *Journ. de Médecine de Bruxelles*, 1867 and 1868; Wittstein's *Vierteljahresschrift f. prakt. Pharm.* xviii. (1869) 73.

[4] *Manuel de Matière Médicale*, i. (1865) 290.

Oil of valerian as obtained from the dried root, is a mixtu valerianic acid (about 5 per cent.), *Valerene* or *Borneene* $C^{10}H^{16}$ (abo per cent.) and 70 per cent. of oxygenated compounds, partly crystalli at 0° C., and easily resinifying. The nature of these compounds ha yet been distinctly made out; among them have been found *Va* $C^6H^{10}O$, and a camphor, $C^{10}H^{18}O$, identical with *Borneol* or Dryobala Camphor. Valerene much resembles oil of turpentine. The co sition of the neutral oil yielded by the fresh root is doubtless sim and ought to be ascertained.

Valerianic Acid, $C^5H^{10}O^2$, was discovered in valerian root by P in 1819, and more fully examined by Grote in 1830. In compos and most of its properties, it is the same as the valerianic acid prod by the oxidation of amylic alcohol; but in certain other points, t acids do not agree.[1]

After distillation of the oil, there is found a strongly acid res containing malic acid, resin, and sugar,—the last capable, accordi Schoonbroodt, of reducing cupric oxide.

Uses—Valerian is employed as a stimulant and antispasmodic.

Substitute—The less aromatic and now disused root of *Valer Phu* L., consists of a thicker rhizome which lies in the earth obliqu it is less closely annulated and rooted at the bottom only.

COMPOSITÆ.

RADIX INULÆ.

Radix Enulæ, Radix Helenii; Elecampane;[2] F. *Racine d'Aunée* G. *Alantwurzel.*

Botanical Origin—*Inula Helenium* L.—This stately perennial is very widely distributed, occurring scattered throughout the who central and southern Europe, and extending eastward to the Cauc Southern Siberia and the Himalaya. It is found here and there rently wild in the south of England and Ireland, as well as in Sou Norway and in Finland (Schübeler).

Elecampane was formerly cultivated in gardens as a medicina culinary plant, and in this manner has wandered to North America Holland and some parts of England and Switzerland, it is cultivat a somewhat larger scale.

History—The plant was known to the ancients as Celsus, Colu Dioscorides, and Pliny, in whose time it was used both as a me and a condiment. Marcellus Empiricus in the 5th century, a Isidore in the beginning of the 7th, name it as *Inula*, the latter a —"quam *Alam* rustici vocant." It is frequently mentioned i Anglo-Saxon writings on medicine, current in England prior t Norman Conquest; and was generally well known during the m ages. Not only was its root much employed as a medicine, but also candied and eaten as a sweetmeat.

[1] Schorlemmer, *Chemistry of the Carbon Compounds*, 1874. pp. 162–165.

[2] A corruption of *Enula Campa* latter word referring to the growth plant in Campania (Italy).

Description—For pharmaceutical use, the root is taken from plants · or three years old; when more advanced, it becomes too woody. · principal mass of the root is a very thick short crown, dividing ow into several fleshy branches of which the larger are an inch or · in diameter, covered with a pale yellow bark, internally whitish and y. The smaller roots are dried entire; the larger are variously sliced, ich occasions them to curl up irregularly. When dried, they are of ght grey, brittle, horny, smooth-fractured. Cut transversely, the young t exhibits an indistinct radiate structure, with a somewhat darker ıbial zone separating the thick bark from the woody nucleus. The h is not sharply defined, and is often porous and hollow. In the er roots the bark is relatively much thinner, and the internal subace is nearly uniform. Elecampane root has a weak aromatic odour gestive of orris and camphor, and a slightly bitter, not unpleasant, matic taste.

Microscopic Structure—The medullary rays, both of the woody ımn and the inner part of the bark (*endophlœum*), exhibit large ıam-ducts. In the fresh root they contain an aromatic liquid, which it dries deposits crystals of helenin, probably derived from the ntial oil. The parenchymatous cells of the drug are loaded with in in the form of splinter-like fragments, devoid of any peculiar cture.

Chemical Composition—It was observed by Le Fèbvre[1] as early 660, that when the root of elecampane is subjected to distillation ı water, a colourless crystallizable substance collects in the head of receiver, from which it speedily passes on as the operation proceeds. same substance may also be observed after carefully heating a thin e of the root, and it is even found as a natural efflorescence on the ace of root that has been long kept. It has a faint odour and natic taste, is fusible at 72° C., and readily soluble in alcohol, but in water. Until recently it has been considered a distinct body er the name of *Helenin*;[2] but from the investigations of Kallen,[3] ould appear to be a compound of two substances, both crystallizable, one of which he calls *Helenin* and the other *Alantcamphor*. Kallen gns to his helenin the formula C^6H^8O; and describes the substance usible at 110° C. and devoid of odour and taste. Alantcamphor (i.e. *ampane-camphor*) has probably the formula $C^{10}H^{16}O$; it melts at C., and in taste and smell is suggestive of peppermint. It is very icult entirely to remove helenin from alantcamphor, these substances ng soluble to nearly the same extent in alcohol or ether. By dising the second of them with pentasulphide of phosphorus, *Cymol*, H^{14}, was obtained. Volatile oil appears to be present in elecampane. The substance most abundantly contained in elecampane root is *ulin*, discovered in it by Valentine Rose in 1804. It has the same sposition as starch, $C^{10}H^{20}O^{10}$, but stands to a certain extent in oppoon to that substance, which it replaces in the root-system of *Comıtæ*. Inulin has not yet been detected with certainty in plants of any er tribe.

[1] Apoticaire ordinaire du Roy, distillateur nique de sa Majesté—*Traité de la nie*, Paris, i. (1660) 375-377.

[2] Gmelin, *Chemistry*, xvii. (1866) 522.

[3] *Berichte der Deutschen Chemischen Gesellschaft*, 1874. 1506.

In living plants, inulin is dissolved in the watery juice, and on drying is deposited within the cells in amorphous masses, which in polarized light are inactive, and are not coloured by iodine. There are various other characters, by which inulin differs from starch. Thus for instance, inulin readily dissolves in about 3 parts of boiling water; the solution is perfectly clear and fluid, not paste-like; but on cooling deposits nearly all the inulin. The solution is levogyre and is easily transformed into uncrystallizable sugar. With nitric acid, inulin affords no explosive compound as starch does.

Sachs showed in 1864, that by immersing the roots of elecampane or *Dahlia variabilis* or of many other perennial *Compositæ*, in alcohol or glycerin, inulin may be precipitated in a crystalline form. Its globular aggregates of needle-shaped crystals ("sphæro-crystals") then exhibit under the polarizing microscope, a cross similar to that displayed by starch grains.

The amount of inulin varies according to the season, but is most abundant in the autumn. Of the various sources for it, the richest appears to be elecampane; Dragendorff, who has made it the subject of a very exhaustive treatise,[1] obtained from the root in October not less than 44 per cent., but in spring only 19 per cent.

In the roots of the *Compositæ*, inulin is accompanied according to Popp,[2] by two closely allied substances, *Synanthrose*, $C^{12}H^{22}O^{11} + H^2O$, and *Inuloïd*, $C^6H^{10}O^5 + H^2O$. Synanthrose is soluble in dilute alcohol, devoid of any rotatory power, and deliquescent. Inuloïd is much more readily soluble in water than inulin. Both these substances are probably present in elecampane.

Uses—Elecampane is an aromatic tonic, but as a medicine is now obsolete. It is chiefly sold for veterinary practice. In France and Switzerland (Neuchâtel), it is employed in the distillation of *Absinthe*.

RADIX PYRETHRI.

Pellitory Root, Pellitory of Spain; F. *Pyrèthre salivaire;* G. *Bertramwurzel.*

Botanical Origin—*Anacyclus Pyrethrum* DC. (*Anthemis Pyrethrum* L.), a low perennial plant with small, much divided leaves, and a radiate flower resembling a large daisy. It is a native of Algeria, growing on the high plateaux that intervene between the fertile coast regions and the desert.

History—The πύρεθρον of Dioscorides was an umbelliferous plant, the determination of which must be left to conjecture. The pellitory of modern times was familiar to the Arabian writers on medicine, one of whom, Ibn Baytar (ob. A.D. 1248), describes it very correctly from specimens gathered by himself near the city of Constantine in Algeria. The plant, says he, called by the Berbers *sandusab*, is found nowhere but in Western Africa, from which region it is carried to other countries.[3]

Pellitory root is a favourite remedy in the East, and has long been

[1] *Materialien zu einer Monographie des Inulins*, St. Petersburg, 1870. 141 pages.—See also *Prantl's* paper on Inulin, as abstracted in *Pharm. Journ.* Sept. 1871. 262.

[2] Wiggers and Husemann. *Jahresbericht* for 1870. 68.

[3] Sontheimer's translation, ii. (1842) 17[illegible]

e of export by way of Egypt to India. An Arabic name for it is *rhd* or *Akulkara*, a word which under slight variations, is found rincipal languages of India. In Germany, pellitory was known as the 12th century; it is named in the oldest printed works on medica.

cription—The root as found in the shops is simple, 3 to 4 ong by $\frac{3}{8}$ to $\frac{1}{2}$ of an inch thick, cylindrical, or tapering, some-rminated at top by the bristly remains of leaves, and having w hair-like rootlets. It has a brown, rough, shrivelled surface, act and brittle, the fractured surface being radiate and destitute The bark, at most $\frac{1}{25}$ of an inch thick, adheres closely to the narrow zone of cambium intervening. The woody column is l by large medullary rays in which, as in the bark, numerous in-ducts are scattered. The root has a slight aromatic smell, ersistent, pungent taste, exciting a singular tingling sensation, markable flow of saliva. The drug is very liable to the attacks s.

roscopic Structure—The cortical part of this root is remark-account of its suberous layer, which is partly made up of scleren-thick-walled cells). Balsam-ducts (oil-cells) occur as well in the cortical layer as in the medullary rays. Most of the parenchy-cells are loaded with lumps of inulin; pellitory in fact is one of ots most abounding in that substance.

mical Composition—Pellitory has been analysed by several , whose labours have shown that its pungent taste is due in rt to a resin, not yet fully examined. The root also contains a latile oil, besides sugar, gum, and a trace of tannic acid. The *Pyrethrin* is a mixed substance.

mmerce—The root is collected chiefly in Algeria and is exported an and to a smaller extent from Algiers. But from the informa-have received from Colonel Playfair, British Consul-General for and from Mr. Wood, British Consul at Tunis, it appears that er part is shipped from Tunis to Leghorn and Egypt. Mr. Wood ormed that the drug is imported from the frontier town of in Algeria into the regency of Tunis, to the extent of 500 50,000 lb.) per annum.

ay imported in the year 1871–72, 740 cwt. of this drug, of ore than half was shipped to other ports of India.[1]

s—Chiefly employed as a sialogogue for the relief of tooth-ache. ally in the form of tincture as a stimulant and rubefacient.

stitute—In Germany, Russia and Scandinavia, African pellitory ed by the root of *Anacyclus officinarum* Hayne, an annual herb tivated in Prussia and Saxony.[2] Its root of a light grey is only nick as that of *A. Pyrethrum*, and is always abundantly provided erent remains of stalks and leaves. It is quite as pungent as he perennial species.

[1] *nt of the Trade and Navigation ndency of Bombay* in 1871–72, 8.

[2] For further information on the medicinal species of *Anacyclus*, see a paper by Dr. P. Ascherson in *Bonplandia*, 15 April, 1858.

FLORES ANTHEMIDIS.

Chamomile Flowers; F. *Fleurs de Camomille Romaine;* G. *Rö Kamillen.*

Botanical Origin—*Anthemis nobilis* L., the Common or F Chamomile, a small creeping perennial plant, throwing up in the part of the summer, solitary flower-heads.

It is abundant on the commons in the neighbourhood of Londo generally throughout the south of England; and extends to Ireland, not a native of Scotland. It is plentiful in the west and centre of F Spain, Portugal, Italy and Dalmatia; and occurs as a doubtful nati Southern and Central Russia.

History—The identification of the chamomile in the classica other ancient authors seems to be impossible, on account of the number of allied plants having similar inflorescence.

The chamomile has been cultivated for centuries in English ga the flowers being a common domestic medicine. The double variet well known in the 16th century.

The plant was introduced, according to Gessner, into Germany Spain about the close of the middle ages. Tragus first designa *Chamomilla nobilis,*[1] and Joachim Camerarius, who had observ abundance near Rome, gave it the name of *Roman Chamomile.*

Production—The chamomile is cultivated at Mitcham, near Lo the land applied to this purpose being in 1864 about 55 acres, an yield reckoned at about 4 cwt. per acre. The flowers are car gathered, and dried by artificial heat; and fetch a high price i market.[2]

The plant is grown on a large scale at Kieritzsch, between L and Altenburg, and near Zeiz and Borna, all in Saxony; and likew some extent in Belgium and France.

Description—The chamomile flowers found in commerce are those of the wild plant, but are produced by a variety in which the tu florets have all, or for the greater part, been converted into li florets. In the flowers of some localities, this conversion has bee complete, and such flowers having a somewhat yellow centre, are by druggists *Single Chamomiles;* while those in which all the flor ligulate and white, are known as *Double Chamomiles.*

Chamomile flowers have the general structure found in the *Compositæ.* They are $\frac{1}{2}$ to $\frac{3}{4}$ of an inch across, and consist of a spherical involucre about $\frac{3}{8}$ of an inch in diameter, composed of a n of nearly equal bracts, scarious at the margin. The receptacle is conical, about $\frac{1}{4}$ of an inch in height, beset with thin, concave. narrow, chaffy scales, from the bases of which grow the numerous In the wild plant, the outer of these to the number of 12 or mo white, narrow, strap-shaped, and slightly toothed at the apex. central or disc florets are yellow and tubular, with a somewha

[1] *De Stirpium . . .*, 1552. 149.—In Germany the epithet *edel* (= *nobilis*) is frequently used in popular botany to designate useful or remarkable plants. Tragus may have been induced to bestow it on the species under notice, on account of its su to *Matricaria Chamomilla*, the Common *Chamomile* of the Germans

[2] About £9 per cwt., Foreign miles being worth from £3 to £4.

ed summit from which project the two reflexed stigmas. In the rated plant, the ligulate florets predominate, or replace entirely the lar. The florets which are wholly destitute of pappus are reflexed, at the capitulum when dried has the aspect of a little white ball. ite oil-glands are sparingly scattered over the tubular portion of the s of either kind. The flowers of chamomile as well as the green of the plant, have a strong aroma, and a very bitter taste.

n trade, dried chamomile flowers are esteemed in proportion as they of large size, very double, and of a good white—the last named ity being due in great measure to fine dry weather during the flower-eriod. Flowers that are buff or brownish, or only partially double, nand a lower price.

Chemical Composition—Chamomile flowers yield about ½ per of essential oil, which is at first of a pale blue, but becomes wish-brown in the course of a few months. The recent researches emarçay (1873) show that this oil is to be regarded as a mixture of lic and amylic angelate and valerate, which bodies are easily decom-d by the action of caustic alkali. In fact, by gently warming for a ent 6 parts of the oil with 5 parts of potash, Jaffé (1865) obtained late of potassium which, treated with dilute sulphuric acid, afforded *lic Acid*, fusible at 45° C. The whole amount of angelic acid is not isolated in a crystalline form; but this may be accomplished if a nt of nitrous acid is conducted through the liquid, in which case ngelic acid floats on the surface as an oily layer. By this treat-, 50 parts of crude angelic acid or 30 of the pure acid, may be ned from every 100 parts of oil used.

At Mitcham, oil of chamomile is usually distilled from the *entire t*, after the best flowers have been gathered. The oil has a shade of n, to remove which it is exposed to sunlight; it thus acquires a nish-yellow colour, at the same time throwing down a considerable nit.

Camboulises (1871) extracted from double chamomiles, a bitter acid ing needle-like prisms, but in too small quantity to allow of sis; he regarded it as identical with the *Anthemic Acid*, obtained attone (1859) from *Anthemis arvensis*. He was unable to discover amomile the *Anthemine* of the latter chemist, or any other alka-

We have performed some experiments in order to isolate the *bitter iple*, but have not succeeded in obtaining it in a satisfactory state rity; it forms a brown extract, apparently a glucoside. We can confirm the statement that no alkaloid is present.

Uses—An infusion or an extract of chamomile is often used as a r stomachic and tonic.

Adulteration and Substitution—The flower-heads of *Matricaria nomilla* L., designated in Germany *Common Chamomiles* (*gemeine illen*), are sometimes asked for in this country. In aspect as well n odour, they are very different from the chamomiles of English macy; they are quite single, not bitter, and have the receptacle id of scales and hollow.

A cultivated variety of *Chrysanthemum Parthenium* Pers., or Feverfew, the florets all ligulate, and some scales on the receptacle (not

having the receptacle *naked*, as in the wild form), common in gar has flower-heads exceedingly like double chamomiles. But they m distinguished from the latter by their *convex* or *nearly flat* recep with the scales lanceolate and acute, and less membranous.

The chamomiles of the Indian bazaars which are brought from I and known as *Bábúnah*, are (as we infer from the statement of I the flowers of *Matricaria suaveolens* L., a slender form of *M. Chamo* growing in Southern Russia, Persia, Southern Siberia, also in America.

The fresh wild plant of *Anthemis nobilis* L., pulled up fro ground, is sold in London for making extract, a proceeding highly r hensible supposing the extract to be sold for medicinal use.

SANTONICA.

Flores Cinæ, Semen Cinæ,[2] *Semen Santonicæ, Semen Zedoariæ,* *Contra, Semen Sanctum; Wormseed;* F. *Semen-contra, Sem Barbotine;* G. *Wurmsamen, Zitwersamen.*

Botanical Origin—*Artemisia maritima*, var. *a. Stechman* Besser[3] (*A. Lerchcana* Karel. et Kiril. in Herbb. Kew. et Mus. *A. maritima* var. *a. pauciflora* Weber, quoad Ledebour, *Flor. Ross.* ii.

Artemisiæ of the section *Seriphidium* assume great divers form[4]: they have been the object of attentive study on the part Russian botanists Besser (1834–35) and Ledebour (1844–46), researches have resulted in the union of many supposed species, the head of the Linnæan *Artemisia maritima*. This plant h extremely wide distribution in the northern hemisphere of t world, occurring mostly in saltish soils. It is found in the salt m of the British Islands, on the coasts of the Baltic, of France a Mediterranean, and on saline soils in Hungary and Podolia; the extends eastward, covering immense tracts in Southern Russi regions of the Caspian, and Central Siberia, to Chinese Mongolia.

The particular variety which furnishes at least the chief part drug, is a low, shrubby, aromatic plant, distinguished by its very erect, ovoid flowerheads, having oblong, obtuse, involucral scal interior scales being scarious. The stem in its upper half is a fas thyrsoid panicle, crowded with flowerheads. The localities for th are the neighbourhood of the Don, the regions of the lower Volg Zarepta and Zaritzya, and the Kirghiz deserts.

The drug, which consists of the minute, unopened flowerhe collected in large quantities, as we are informed by Björklund (18

[1] Is not this plant the *Anthemis? parthenioides* Bernh., of which De Candolle says (*Prod.* vi. 7)—". . . simillima *Mat. Parthenio*, sed paleis inter flores instructa. Ferè semper plena in hortis occurrit, et forte ideo paleæ receptaculi ex luxuriante statu ortæ ut in *Chrysanthemi indico et sinensi* . . ."!

[2] From the Italian *semenzina*, the diminutive of *semenza* (seed).

[3] W. S. Besser in *Bulletin de la Soc. imp. des Naturalistes de Moscou*, vii. (1834) 31.—A specimen of the plant in question labelled in Besser's handwriting, with a meme that it is collected for medicinal u the Herbarium of the Royal Garden It completely agrees with the Sera of Russian and German commerc remark also applies to a specimen of *chcana* Karel. et Kiril. in the sa barium.

[4] "Si aliæ Artemisiæ multum Seriphidia inconstantiâ formarum superant. . ."—Besser.

vast plains or steppes of the Kirghiz, in the northern part of Turkestan. It was formerly gathered about Zarepta, a thriving German colony in the Government of Saratov, but from direct information we have lately (1872) received, it appears to be obtained there no longer.

The emporium for wormseed is the great fair of Nishnei-Novgorod. Hence the drug is conveyed to Moscow, St. Petersburg, and Western Europe.

Wormseed is found in the Indian bazaars. A specimen received by us from Bombay does not materially differ in form from the Russian drug, but is slightly shaggy and mixed with tomentose stalks. It is probably brought from Afghanistan and Cabul.[1]

Wilkomm[2] has lately described as mother-plant of wormseed, an *Artemisia* which he calls *A. Cina*. It was obtained in Turkestan by Prof. Petzholdt, who received it from the people gathering the drug. The specimen kindly communicated to us by Prof. Wilkomm, has flowerheads which do not entirely resemble the wormseed of trade, in that they have fewer scales.

History—Several species of *Absinthium* are mentioned by Dioscorides, one of which called Ἀψίνθιον θαλάσσιον or Σέριφον, having very small seeds (capitules), and growing in Cappadocia, he states to be taken honey as a remedy for ascarides and lumbrici: one can hardly doubt that this is the modern wormseed. Another species is described by the same author as being called Σαντόνιον, from it growing in the country of the Santones in Gaul (the modern Saintonge); he asserts it resemble σέριφον in its properties.

In an epistle on intestinal worms attributed to Alexander Trallianus,[3] who practised medicine with great success at Rome in the 6th century, the use is recommended of *Absinthium marinum* (θαλασσία ἀψίνθη), as sure for ascarides and round worms.

Semen sanctum vel Alexandrinum is mentioned as a vermifuge for children by Saladinus about A.D. 1450, and by Ruellius, Dodonæus, the Fuchsins, and other naturalists of the 16th century. Its ancient reputation has been fully maintained in modern times, and in the form partly of *Santonin*, the drug is still extensively employed.

Description—Good samples of the drug consist almost exclusively of entire, unopened flowerheads or capitules, which are so minute that it requires about 90 to make up the weight of one grain. In samples less pure, there is an admixture of stalks, and portions of a small pinnate leaf. The flowerheads are of an elliptic or oblong form, about $\frac{1}{10}$ of an inch long, greenish yellow when new, brown if long kept; they grow singly, less frequently in pairs, on short stalks, and are composed of about 18 oblong, obtuse, concave scales, closely imbricated. The involucre is much narrowed at the base in consequence of the innermost scales being considerably shorter than the rest. The capitule is sometimes associated with a few of the upper leaves of the stem, which are short, narrow, and simple. Notwithstanding its compactness,

[1] *Artemisia* No. 3201, Herb. Griffith, Afghanistan, in the Kew Herbarium has capitules precisely agreeing with this Bombay

[2] *Bot. Zeitung*, 1 März, 1872, 130; *Pharm. Journ.* 23 March, 1872, 762 (abstract).

[3] Contained in a work by Hieronymus Mercurialis, entitled *Variarum Lectionum libri quatuor*, Venet. 1570.

the capitule is somewhat ridged and angular,[1] from the involucral s
having a strong, central nerve or keel. The middle portion of
scale is covered with minute, yellow, sessile glands, which are wa
on the transparent scarious edge. The latter is marked with extr
fine striæ and is quite glabrous; in the young state the keel be
few woolly colourless hairs, but at maturity the whole flowerh
shining and nearly glabrous.[2] The florets number from 3 to 5;
have (in the bud) an ovoid corolla, glandular in its lower portion, a
longer than the ovary, which is destitute of pappus.

Wormseed when rubbed in the hand exhales a powerful and agr
odour, resembling cajuput oil and camphor; it has a bitter aromatic

Chemical Composition—Wormseed yields about 1 per c
essential oil, having its characteristic smell and taste. The oil b
175° C.; it consists mainly, as the investigations of Kraut (18
have shown, of Hirzel's *Cinæbene-Camphor*, $C^{10}H^{18}O$, which whe
tilled, easily gives off H^2O, so that part of the oil is resolve
$C^{10}H^{16}$ and water, which latter produces a turbidity in the prev
dehydrated oil. The hydrocarbon has no action on polarized lig
the crude oil is slightly lævogyrate. The latter also originally co
a possibly different, isomeric hydrocarbon, Hirzel's *Cinæbene*, Vö
Cinene or *Cynene*.

The water which distils over, carries with it volatile acids
fatty series, also (as in the case of *Anthemis nobilis* L.) *Angelic A*

The substance to which the remarkable action of wormseed
human body[3] is due, is *Santonin*, $C^{15}H^{18}O^3$. It was discovered in 1
Kahler, an apothecary of Düsseldorf, who gave a very brief notic
in the *Archiv der Pharmacie* of Brandes (xxxiv. 318). Imme
afterwards Augustus Alms, a druggist's assistant at Penzlin in the
duchy of Mecklenburg-Schwerin, knowing nothing of Kahler's dis
obtained the same substance and named it *Santonin*. Alms recom
it to the medical profession, pointing out that it is the anthe
principle of wormseed.[4] Santonin constitutes from 1½ to 2 p
of the drug, but appears to diminish in quantity very considerably
flowers open. It is easily extracted by milk of lime, for, tho
an acid and but sparingly soluble in water even at a boiling he
capable of combining with bases. It is inodorous, but has a bitt
especially when dissolved in chloroform or alcohol.[5]

Santonin forms colourless rectangular tabular crystals, whic
exposed to daylight, or to the blue or violet rays, but not to th
colours of the spectrum, assume a yellow hue, and split into in
fragments. It has not been proved that this change, which tak
even under water, alcohol, or ether, is accompanied by any ch

[1] Maceration in water, which restores the natural shape of the flowerheads, shows that this shrunken, angular form is not found in the growing plant.

[2] Yet too much stress must not be laid on this character, for as Besser remarks – "*pericliniii squamæ in uno loco tomento brevi plus minusve canæ, in aliis nudæ, imo nitidæ.*"

[3] As the affected vision, so that objects appear as if seen through a yellow medium. Other effects are recorded by Stil peutics and Mat. Med. ii. 641).

[4] The paper of Alms being con the very same periodical (p. 319) a Kahler (and further in vol. xxx affords additional evidence of the dence of the discovery.

[5] Its ready solubility in 3 or 4 chloroform, renders its estimation c mixed with sugar, as in a santonin

tion. Yet Sestini (1865) has asserted that the yellow santonin or 'o-*santonin*" has a different composition, namely $C^{23}H^{34}O^{6}$, and er fusing point. The behaviour of santonin when exposed to light, bles that of erythrocentaurin, $C^{27}H^{24}O^{8}$. The latter has been ted by means of ether, from the alcoholic extract of *Erythræa urium*, and of some other *Gentianaceæ*. Méhu (1866) has shown the colourless crystals of that substance when exposed to sun- assume a brilliant red colour, *without* undergoing any chemical tion. The *colourless* solutions of this body in chloroform or ol yield the original substance. With due precautions, santonin be sublimed unchanged.

ccording to Hesse (1873), it appears that santonin is the anhy- of a crystallizable body which he calls *Santoninic Acid*, $C^{15}H^{20}O^{4}$; this acid is heated to 120° C., it is resolved into santonin and . Cannizzaro and Sestini have shown (1873) that when santonin ated with an alkali, it may be converted into *Santonic Acid*, a ance isomeric with santoninic acid, but not resolvable like the into santonin and water.

'ormseed contains in addition to the two bodies just described, sugar, waxy fat, salts of calcium and potassium, and malic acid; carefully selected and dried, it yielded us 6·5 per cent. of ash, rich ca.

ommerce—Ludwig of St. Petersburg has stated that the imports rmseed into that city were about as follows:—In 1862, 7400 cwt.; 63, 10,500 cwt.; in 1864, 11,400 cwt. The drug was brought from irghiz steppes by Semipalatinsk and by Orenburg.

ses—The drug is employed exclusively for its anthelmintic pro- s, partly in the form of santonin. It proves of special efficacy for islodgement of *Ascaris lumbricoides*.

RADIX ARNICÆ.

Arnica Root; F. *Racine d'Arnica*; G. *Arnicawurzel*.

otanical Origin—*Arnica montana* L., a perennial plant growing adows throughout the northern and central regions of the northern phere, but not reaching the British Islands. In western and cen- urope, it is an inhabitant of the mountains, but in colder countries ws in the plains.

high latitudes, as in Arctic Asia and America, a peculiar form of lant distinguished by narrow, almost linear leaves has been named *gustifolia* Vahl; but numerous transitional forms prove its identity the ordinary *A. montana* of Europe.

istory—The older botanists as Matthiolus, Gessner, Camerarius, mæmontanus, and Clusius were acquainted with arnica and had knowledge of its medicinal powers. It appears to have been a ar remedy in Germany at an early period, but was only introduced egular medicine about 1712, on the recommendation of Johann el Fehr of Schweinfurt and of several other physicians. But for iastic laudation of the new remedy, all these writers fall far short llin of Vienna, who imagined that in arnica he had found a Euro-

pean plant possessing all the virtues of Peruvian Bark.[1] In his h fevers and agues gave way under its use, and more than 1000 pat in the Pazman Hospital were alleged to have been cured of inte tents by an electuary of the flowers, between 1771 and 1774! S happy results were not obtained by other physicians.

Arnica (*herba, flos, radix*) had a place in the London Pharmaco of 1788, but it soon fell out of notice, so that Woodville writing in 1 remarks that he had been unable to procure the plant from any o London druggists. Of late years it has gained some popular noto as an application in the form of tincture, for preventing the black of bruises, but in England it is rarely prescribed internally.

Description—The arnica root of pharmacy consists of a sh contorted, dark-brown rootstock, an inch or two long, emitting fro under side an abundance of wiry simple roots, 3, 4 or more inch length; it usually bears the remains of the rosette of character ovate, coriaceous leaves, which are 3- to 5-nerved, ciliated at the ma and slightly pubescent on their upper surface. It has a faintly aro herby smell, and a rather acrid taste.

Microscopic Structure—On a transverse section, the rootstoc hibits a large pith surrounded by a strong woody ring. In the inne part of the cortical layer, large oil-ducts are found corresponding fibro-vascular bundles. Neither starch granules, inulin, or oxal calcium are visible in the tissue. The rootlets are of a different stru character, but also contain oil-ducts.

Chemical Composition—Several chemists have occupied selves in endeavouring to isolate the active principle of arnica. B described (1851) a substance which he obtained in minute quantity the flowers and named *Arnicine*. He states it to possess alkalin perties, to be non-volatile, slightly soluble in water, more so in alco ether; when neutralized with hydrochloric acid, it forms a crystallin

The *Arnicin* extracted by Walz (1861) both from the root and fl of arnica is a different substance; it is an amorphous yellow m acrid taste, slightly soluble in water, freely in alcohol or ether, an solving also in alkaline solutions. It is precipitable from its alc solution by tannic acid or by water. Walz assigns to arnicin th mula $C^{20}H^{30}O^{4}$; other chemists that of $C^{35}H^{54}O^{7}$. Arnicin has n been proved a glucoside, although it is decomposed by dilute acids.

Sigel[2] obtained from dried arnica root about ½ per cent. of ess oil, and 1 per cent. from the fresh; the oil of the latter had a sp. 0·999 at 18° C. The composition of the oil is represented by the fo $C^{6}H^{9}O$; but it was found to be a mixture of various bodies, the pri being *Dimethylic Ether of Thymohydroquinone*. The water from the oil separated, contains *Isobutyric Acid*, probably also a little A and *Formic Acid*; but neither capronic nor caprylic acid, whic been pointed out by Walz.

Arnica root contains *Inulin*, which Dragendorff extracted from the extent of about 10 per cent.

Uses—Arnica is used chiefly in the form of tincture as a popular

[1] *Arnica, in febribus et aliis morbis putridis vires*,—in the *Anni Medici* of Störck and Collin, ed. nov., Amstel., iii. (177

[2] Liebig's *Annalen*, clxx. (1873) 3

o bruises and chilblains; internally it is occasionally prescribed ıulant and diaphoretic.

lteration—Arnica root has recently been met with[1] adulterated e root of *Geum urbanum* L., a common herbaceous plant of the *sacea*. The latter is thicker than the rhizome of arnica, being $\frac{1}{6}$ of an inch in diameter; it is a true *root*, furnished on all th rootlets, and has an *astringent* taste. The leaves of *Geum* are and quite unlike those of arnica.

Flores Arnicæ.

ica montana produces large, handsome, orange-yellow flowers, at the summit of the stem or branches. The involucral scales of tulum (20 to 24) are of equal length, but are imbricated, forming e row. They are very hairy, the shorter hairs being tipped with lands. The receptable is chaffy, $\frac{1}{4}$ of an inch in diameter, with) ligulate florets, and of tubular a much larger number. The ligu- ets, an inch in length, are oblong, toothed at the apex, and tra- y about 10 parallel veins. The achenes are brown and hairy, l by pappus consisting of a single row of whitish barbed hairs. ica flowers have a weak, not unpleasant odour; they were for- sed in making the tincture, but as the British Pharmacopœia ects that preparation to be made with the root, they have almost ıt of use, at least in Great Britain. They appear to be rather in arnicin than the root, and are said to be fully equal if not r to it in medicinal powers; yet the essential oil they contain is same.

RADIX TARAXACI.

lion Root, Taraxacum Root; F. *Pissenlit;* G. *Löwenzahnwurzel.*

tanical Origin—*Taraxacum officinale* Weber (*T. Dens-leonis* *eontodon Taraxacum* L.), a plant of the northern hemisphere, ver the whole of Europe, Central and Northern Asia, and North a, extending to the Arctic regions. It varies under a considerable of forms, several of which have been regarded as distinct species. y districts it is a troublesome weed.

tory—Though the common Dandelion is a plant which must en well known to the ancients, no distinct reference to it can be n the classical authors of Greece and Italy. The word *Taraxacum* ver usually regarded as of Greek origin;[2] we have first met with *rakhshagūn*, in the works of the Arabian physicians, who speak a sort of *Wild Endive*. It is thus mentioned by Rhazes in the ıd by Avicenna in the 11th century.

name *Dens Leonis*, an equivalent of which is found in nearly all guages of Europe, is stated in the herbal of Johann von Cube[3] been bestowed on this plant by one Wilhelm, a surgeon, who in great esteem; but of this personage and of the period during he lived, we have sought information in vain. Dandelion was

es in *Pharm. Journ.* April 11.

ps from τράξυνον or τρόξυνον sig- *Wild Lettuce;* according to some, ξις, a disease of the eye which the plant was used to cure, or from the verb τάρασσω, *I disturb.*

[3] *Herbarius zu teutsch und von aller handt kreuteren*, Augspurg, 1488. cap. clii.

ion of the filtered solution with sulphuretted hydrogen and evaporation dryness. The residue then yielded to ether an acrid resin, and left a ourless amorphous mass of intensely bitter taste, named by Kromayer *raxacin*. Polex (1839) obtained apparently the same principle in rty crystals; he simply boiled the milky juice with water and allowed concentrated decoction to evaporate.

The portion of the "*Leontodonium*" not dissolved by water, yields to ohol a crystalline substance, Kromayer's *Taraxacerin*, $C^{8}H^{16}O$. It embles lactucerin and has in alcoholic solution an acrid taste. How the medicinal value of dandelion is dependent on the substances thus racted, is not yet known.

Dragendorff (1870) obtained from the root gathered near Dorpat in tober and dried at 100 C., 24 per cent. of *Inulin* and some sugar. root collected in March from the same place, yielded only 1·74 per t. of inulin, 17 of uncrystallizable sugar and 18·7 of *Levulin*. The -named substance, discovered by Dragendorff, has the same composition nulin, but dissolves in cold water; the solution tastes sweetish, and levoid of any rotatory power. Inulin is often to be seen as a glisten- powder when extract of taraxacum is dissolved in water.

T. and H. Smith of Edinburgh (1849) have shown that the juice of root by a short exposure to the air, undergoes a sort of fermentation ich results in the abundant formation of *Mannite*, not a trace of ich is obtainable from the perfectly fresh root. Sugar which readily lerwent the vinous fermentation, was found by the same chemists in siderable quantity.

The leaves and stalks of dandelion (but not the roots) were found by rné (1864) [1] to afford the peculiar sugar named *Inosite*, $C^{12}H^{24}O^{12}$.

The root collected in the meadows near Bern immediately before vering, carefully washed and dried at 100° C., yielded us 5·24 per cent. ash, which we found to consist of carbonates, phosphates, sulphates, in smaller quantity also of chlorides.

Uses—Taraxacum is much employed as a mild laxative and tonic, cially in hepatic disorders.

Adulteration—The roots of *Leontodon hispidus* L. (Common Hawk- have occasionally been supplied by fraudulent herb-gatherers in e of dandelion. Both plants have runcinate leaves, but those of kbit are hairy, while those of dandelion are smooth. The (fresh) of the former is tough, breaking with difficulty and rarely exuding milky juice.[2]

The dried root of dandelion is exceedingly liable to the attacks of gots, and should not be kept beyond one season.

HERBA LACTUCÆ VIROSÆ.

Prickly Lettuce; F. *Laitue vireuse*; G. *Giftlattich*.

Botanical Origin—*Lactuca virosa* L.,[3] a tall herb occurring on r ground, banks and roadsides, throughout Western, Central and

melin, *Chemistry*, xv. (1862) 351.
ilea, *Pharm. Journ.* xi. (1852) 107.
ntham unites this plant with *L. Scariola* L., but in most works on botany they are maintained as distinct species.

Southern Europe. It is abundant in the Spanish Peninsula a France, but in Britain is only thinly scattered, reaching its no limit in the south-eastern Highlands of Scotland.

History—The introduction of this lettuce into modern medi due to Collin, a celebrated physician of Vienna, who about the yea recommended the inspissated juice in the treatment of dropsy. In standing cases, this extract was given to the extent of half an a day.

The College of Physicians of Edinburgh inserted *Lactuca vi* in their pharmacopœia of 1792, while in England its place was tal the Garden Lettuce, *L. sativa* L. The authors of the *British Ph copœia* of 1867 have discarded the latter, and directed that *Ext Lactucæ* shall be prepared by inspissating the juice of *L. virosa*.

Description—The plant is biennial, producing in its firs depressed obovate undivided leaves, and in its second a solitary r stem, 3 to 5 feet high, bearing a panicle of small, pale yellow f resembling those of the Garden Lettuce. The stem which is cyli and a little prickly below, has scattered leaves growing horizontally are of a glaucous green, ovate-oblong, often somewhat lobed, a clasping, with the margin provided with irregular spinescent tee midrib white and prickly. The whole plant abounds in a bitter juice of strong, unpleasant, opiate smell.

Chemical Composition—We are not aware of any modern ch examination having been made of *Lactuca virosa*. The more im constituents of the plant are doubtless those found in *Lactuca* the article on which the reader is referred.

Uses—The inspissated expressed juice of the fresh plant is narcotic and diuretic, but is probably nearly inert.

LACTUCARIUM.

Lactucarium, Lettuce Opium, Thridace;[1] F. and G. *Lactuca*

Botanical Origin—The species of *Lactuca* from which lact is obtained are three or four in number, namely—

1. *Lactuca virosa* L., described in the foregoing article.

2. *L. Scariola* L., a plant very nearly allied to the preced perhaps a variety of it, but having the foliage less abundant, mo cous, leaves more sharply lobed (?), much more erect and almost with the stem. It has the same geographical range as *L. virosa*.

3. *L. altissima* Bieb., a native of the Caucasus, now cultiv Auvergne in France for yielding lactucarium. It is a gigant having when cultivated, a height of 9 feet and a stem 1½ in diameter. Prof. G. Planchon believes it to be a mere variet *Scariola* L.

4. *L. sativa* L., the common Garden Lettuce.[2]

[1] The term Thridace is also applied to *Extract of Lettuce*.

[2] The authors of the French *Codex* of 1866, name as the source of lactucarium, that form of the garden lettuce which has been called by De Candolle *Latuc* Maisch has obtained lactucarium *elongata* Mühl. (*Am. Journ.* 1869. 148.)

History—Dr. Coxe of Philadelphia was the first to suggest that the juice of the lettuce collected in the same manner as opium is collected from the poppy, might be usefully employed in medicine. The result of his experiments on the juice which he thus obtained from the garden lettuce (*L. sativa* L.), and called *Lettuce Opium*, were published in 1799.[1]

The experiments of Coxe were continued some years later by Duncan, Young, Anderson, Scudamore and others in Scotland, and by Bidault de Villiers and numerous observers in France. The production of lactucarium in Auvergne was commenced[2] by Aubergier, pharmacien of Clermont-Ferrand, about 1841.

Secretion—All the green parts of the plant are traversed by a system of vessels, which when wounded, especially during the period of flowering, instantly exude a white milky juice. The stem at first solid and fleshy but subsequently hollow, owes its rigidity to a circle of about 20 fibro-vascular bundles, each of which includes a cylinder of cambium. At the boundary between this tissue and the primary cortical parenchyme, is situated the system of milk-vessels, exhibiting on transverse section a single or double circle of thin-walled tubes, the cavities of which contain dark brown masses of coagulated juice. In longitudinal section, they appear branched and transversely bound together, as in the milk-vessels of taraxacum. The larger of these tubes, 35 mkm. in diameter, correspond pretty regularly in position with the vascular bundles. Each of the latter is also separated from the pith by a band or arch of cambium, in the circumference of which isolated smaller milk-vessels appear.

The system of milk-vessels[3] is therefore double, belonging to the pith on the one side, and to the bark on the other, the two being separated by juiceless wood. The milk-vessels of the bark are covered by only 2 to 6 rows of parenchyme cells of the middle bark, rapidly decreasing in size from within outwards, and these are protected by a not very thick-walled epidermis. Hence it is easy to understand how the slightest puncture or incision may reach the very richest milk-cells.

The drops of milky juice when exposed to the air, quickly harden to small yellowish-brown masses, whitish within.

Collection and Description—Lactucarium has been especially collected since about the year 1845, in the neighbourhood of the small town of Zell on the Mosel, between Coblenz and Trèves in Rhenish Prussia. The introduction of this industry is due to Mr. Goeris, apothecary of that place, to whom we are indebted for the following information and for some further particulars to Mr. Meurer of Zell.

The plant is grown in gardens, where it produces a stem only in its second year. In May just before it flowers, its stem is cut off at about a foot below the top, after which a transverse slice is taken off daily till September. The juice, which is pure white but readily becomes brown on the surface, is collected from the wounded top by the finger, and transferred to hemispherical earthen cups, in which it quickly hardens

[1] Inquiry into the comparative effects of Opium, *Lactucarium*, extracted from the *Papaver somniferum* or *White Poppy* of Asia, and that procured from the *Lactuca sativa* or *Common cultivated Lettuce* of the United States.—*Transact. of the American Philosophical Society*, iv. (1799) 387.

[2] *Comptes Rendus*, xv. (1842) 923.

[3] Beautifully delineated by Hanstein in the work referred to at p. 352, note 2; see also Trécul, *Ann. des Sciences nat.*, [illegible] (1866) 69; Dippel, *Entstehung der Milchsaftgefässe*. Rotterdam 1865. tab. 1. fig. 17.

so that it can be turned out. It is then dried in the sunshine until it can be cut into four pieces, when the drying is completed by exposure to the air for some weeks on frames.

At Zell, 300 to 400 kilogrammes (661 to 882 lb.) of lactucarium are annually produced; the whole district furnishes at best but 20 quintals annually. The price the drug fetches on the spot varies from 4 to 10 thalers per kilogramme (about 6*s.* to 14*s.* per lb.) In the Eifel district where lactucarium was formerly collected, none is now produced.

As found in trade, German lactucarium consists of angular pieces formed as already described, but rendered more or less shrunken and irregular by loss of moisture and by fracture. Externally they are of a dull reddish brown, internally opaque and wax-like, and when recent, of a creamy white. By exposure to the air, this white becomes yellow and then brown. Lactucarium has a strong unpleasant odour, suggestive of opium, and a very bitter taste.

The lactucarium produced by Aubergier of Clermont-Ferrand is of excellent quality, but does not appear to differ from that obtained on the Mosel, except that it is in circular cakes about 1½ inches in diameter, instead of in angular lumps.

Scotch lactucarium, which was formerly the only sort found in the market, is still (1872) met with. Mr. Fairgrieve, who produces it in the neighbourhood of Edinburgh, collects the juice into little tin vessels, in which it quickly thickens; it is then turned out and dried with a gentle heat, the drug being broken up as the process of drying goes on. It is thus obtained in irregular earthy-looking lumps of a deep brown hue, of which the larger may be about an inch in length. In smell, it exactly resembles the drug collected on the Continent.[1]

We are unacquainted with Russian Lactucarium which has been quoted at a very high price in some continental lists.

Chemical Composition—Lactucarium is a mixture of very different organic substances, together with 8 to 10 per cent. of inorganic matter. It is not completely taken up by any solvent, and when heated merely softens but does not melt.

By exhausting with boiling alcohol, it yielded us 58·7 per cent. of *Lactucerin* or *Lactucone*, $C^{16}H^{26}O$, depositing it in crystals which when duly purified have the form of slender colourless needles, fusing at about 185° C. to an amorphous mass. Lactucerin is an inodorous, tasteless neutral substance, insoluble in water, but dissolving in ether and in oils both fixed and volatile, not quite so readily either in benzol, or in bisulphide of carbon. It appears to be closely allied to *Euphorbon*, with which it ought to be accurately compared.

Cold alcohol as well as boiling water, take out of lactucarium about 0·3 per cent. of a crystallizable bitter substance, *Lactucin*, $C^{11}H^{12}O^{5}$, which although it reduces alkaline cupric tartrate, is not a glucoside. Lactucin forms white pearly scales, readily soluble in acetic acid, but insoluble in ether. It loses its bitterness when treated with an alkali.

From the mother-liquors that have yielded lactucin, Ludwig obtained *Lactucic Acid*, as an amorphous light yellow mass, becoming crystalline after long standing. Lastly lactucarium has further afforded in small

[1] We are indebted to Mr. H. C. Baildon for a specimen of Scotch lactucarium collected about the year 1844, and to Messrs. T. and H. Smith for a recent sample of Fairgrieve's article.

ntity, an amorphous substance named *Lactucopicrin*, $C^{44}H^{64}O^{21}$, appa-tly produced from lactucin by oxidation; it is stated by Kromayer 62) to be soluble in water or alcohol, and to be very bitter.

Of the widely diffused constituents of plants, lactucarium contains n, albumen, gum, oxalic, citric, malic and succinic acids, sugar, man-, and asparagin, together with potassium, calcium and magnesium s of nitric and phosphoric acids. We obtained crystals of nitrate of assium by concentrating the aqueous decoction of lactucarium. On illation with water, a volatile oil having the odour of lactucarium, ses over in very small quantity.

Uses—The soporific powers universally ascribed in ancient times to lettuce, are supposed to exist in a concentrated form in lactucarium. numerous experiments have failed to show that this substance esses more than very slight sedative properties, if indeed it is not olutely inert.[1]

LOBELIACEÆ.

HERBA LOBELIÆ.

Lobelia, Indian Tobacco; F. Lobélie enflée; G. Lobeliakraut.

Botanical Origin—*Lobelia inflata* L., an annual herb, 9 to 18 inches , with an angular upright stem, simple or more frequently branching the top, widely diffused throughout the eastern part of North rica from Canada to the Mississippi, growing in neglected fields, g roadsides, and on the edges of woods, and thriving well in European lens.

History—*Lobelia inflata* was described and figured by Linnæus[2] specimens cultivated by him at Upsala about 1741, but he does attribute to the plant any medicinal virtues.

The aborigines of North America made use of the herb, which from circumstance and its acrid taste, came to be called *Indian Tobacco.* Europe it was noticed by Schoepf[3] but with little appreciation of its ers. In America it has long been in the hands of quack doctors, its value in asthma was set forth by Cutler in 1813. It was not loyed in England until about 1829, when with several other remedies, as introduced to the medical profession by Reece.[4]

Description—The leaves are 1 to 3 inches long, scattered, sessile, e-lanceolate, rather acute, obscurely toothed, somewhat pubescent. edge of the leaf bears small whitish glands, and between them ted hairs which are more frequent on the under than on the upper ce. They are usually in greater abundance on the lower and le portions of the stem.

The stem of the growing plant exudes when wounded a small quan-

[1] Pillé, *Therapeutics and Mat. Med.* i. 756. Garrod (*Med. Times and* , 26 March, 1864), gave lactucarium rhm doses, repeated 3 or 4 times a rithout being able to perceive that it ny effect either as an anodyne or tic.

[2] *Acta Soc. Reg. Scient. Upsal.* 1746. 23.

[3] *Mat. Med. Americana*, Erlange, 1787. 128.

[4] *Treatise on the Bladder-podded Lobelia*, Lond. 1829.

tity of acrid milky juice, contained in laticiferous vessels running i into the leaves. The inconspicuous blossoms are arranged in a ma flowered, terminal, leafy raceme. The five-cleft, bilabiate corolla blueish with a yellow spot on the under lip, its tube being as long as somewhat divergent limb of the calyx.

The capsule is ovoid, inflated, ten-ribbed, crowned by five elong sepals which are half as long as the ripe fruit. The latter is two-ce and contains a large number of ovate-oblong seeds about $\frac{1}{50}$ of an i in length, having a reticulated, pitted surface.

The herb found in commerce is in the form of rectangular ca 1 to $1\frac{3}{4}$ inches thick, consisting of the yellowish-green chopped h compressed as it would seem while still moist, and afterwards ne trimmed. The cakes arrive wrapped in paper, sealed up and bearing label of some American druggist or herb-grower.

Lobelia has a herby smell and, after being chewed, a burning, a taste resembling that of tobacco.

Chemical Composition—Lobelia has been examined chemic by Procter (1838–1841), Pereira (1842), Reinsch (1843), Bastick (18 also by F. F. Mayer.[1] The first-named chemist[2] traced the activit the plant to a liquid, volatile alkaloid which he termed *Lobelina*, and observations were confirmed some years later by the independent ex ments of Bastick.[3] From the labours of these chemists it appears lobelina is an oily, viscid, transparent fluid with a strong alkaline action, especially when in solution. In the pure state, it smells slig of the plant, but more strongly when mixed with ammonia. Its t is pungent and tobacco-like, and when taken in minute doses, it e cises in a potent manner the poisonous action of the drug. Lobeli volatile, but does not evaporate entirely unchanged. It dissolve water, but more readily in alcohol or ether, the latter of whic capable of removing it from its aqueous solution. Caustic alk decompose it readily. It neutralizes acids forming with them cry lizable salts, soluble in water or alcohol. The hydrochlorate is descr as forming colourless, transparent, well-defined acicular crystals; a phate, nitrate, and oxalate have been also obtained.

The herb likewise contains traces of essential oil (the *Lobelian* Pereira?), resin and gum. The seeds afforded Procter about 30 per of fixed oil, sp. gr. ·940, which was found to dry very rapidly. *Lobeliin* of Reinsch appears to be an indefinite compound.

In 1871, Enders at our request performed some researches on lo in order to isolate the acrid substance, to which the herb owes its t He exhausted the drug with spirit of wine and distilled the liqu presence of charcoal, which then retained the acrid principle. The coal was washed with water, and then treated with boiling alc This on evaporation yielded a green extract, which was further pu by means of chloroform. Warty tufts were thus finally obtained always of a brownish colour. The tufts are readily soluble in ethe chloroform, but only slightly in water; they possess the acrid tas lobelia. This substance, which we may term *Lobelacrin*, is decom if merely boiled with water; by the influence of alkalis or acids

[1] *American Journ. of Pharm.* xxxvii. (1866) 209; also *Jahresbericht* of Wiggers and Husemann, 1866. 252.

[2] *Am. Journ. of Pharm.* iii. (183 vii. (1841) 1; *Pharm. Journ.* x. (185

[3] *Pharm. Journ.* x. (1851) 270.

l into sugar and *Lobelic Acid.* The latter is soluble both in ınd alcohol, and is non-volatile; it yields a soluble salt with oxide, whereas its plumbic salt is insoluble in water.

:s—Lobelia is a powerful nauseating emetic; in large doses an rcotic poison. It is prescribed in spasmodic asthma.

ERICACEÆ.

FOLIA UVÆ URSI.

berry Leaves; F. *Feuilles de Busserole;* G. *Bärentraubenblätter.*

:anical Origin—*Arctostaphylos Uva-ursi* Sprengel (*Arbutus si* L.), a small, procumbent, evergreen shrub, distributed over the part of the northern hemisphere. It occurs in North America, . Northern Europe and Russian Asia, and on the chief mountain of Central and Southern Europe. In Britain, it is confined to d, the north of England and Ireland.

:tory—The bearberry, previously described by Clusius in 1601, ommended for medicinal use in 1763, by Gerhard of Berlin and It had a place in the London Pharmacopœia for the first time .

ıcription—The leaves are dark green, ¾ to 1 inch in length by of an inch in breadth, obovate, rounded at the end, gradually ɔd into a short petiole. They are entire, with the margin a little l, and in the young state slightly pubescent, otherwise the whole mooth, glabrous, and coriaceous; the upper surface shining, deeply ed with a network of veins; the under minutely reticulated with ins. The leaves have a very astringent taste, and when powdered, te smell.

:mical Composition—Kawalier (1852) has shown that a decoc- bearberry treated with basic acetate of lead, yields a gallate of that thus proving that gallic acid exists ready-formed in the leaves. he filtrate, freed from lead by sulphuretted hydrogen, is properly rated, it deposits acicular crystals of *Arbutin*, $C^{24}H^{32}O^{14},H^2O$, neutral substance, easily soluble in hot water, less so in cold, ng in alcohol, but sparingly in ether.[2]

contact for some days with emulsin, or by boiling with dilute ic acid, arbutin is resolved into *Hydrokinone*, $C^6H^6O^2$ (Kawalier's n), and glucose. The action of peroxide of manganese and dilute ic acid, on the other hand, converts arbutin into *Kinone*, $C^6H^4O^2$, nic acid (p. 325). If a concentrated decoction of the leaves is to stand for some months, a decomposition of the arbutin lace, and a certain quantity of hydrokinone can be isolated by the liquid with ether.

rokinone was likewise found by Uloth (1859) among the products distillation of an aqueous extract of bearberry leaves, together

ıy, *Apparatus Medicaminum*, ii. [2] Gmelin, *Chemistry*, xv. (1862) 419.
-31.

with the isomeric substance *Pyrocatechin* (p. 172). Arbutin itself also yields hydrokinone by means of dry distillation. Hydrokinone forms colourless crystals, melting at 177°·5 C.; kinone crystallizes in brilliant yellow scales, melting at 115°·7 C. and then evolving a peculiar odour. The vapour strongly irritates the eyes, and the watery solution imparts a yellow colour to the skin.

In the mother-liquor from which the arbutin has crystallized, there remains a small quantity of the very bitter substance called *Ericolin*, occurring in greater abundance in other *Ericaceæ*. *Ericolin*, $C^{34}H^{56}O^{21}$, is an amorphous yellowish mass, softening at 100° C. and resolved, when heated with dilute sulphuric acid, into sugar and *Ericinol*, a colourless, quickly resinifying oil, isomeric with the camphor of the *Laurineæ*.[1] It has a peculiar, not disagreeable odour.

H. Trommsdorff in 1854, obtained from bearberry leaves by exhausting them with ether (in which however it is but slightly soluble) the colourless and tasteless crystallizable neutral substance *Ursone*, $C^{30}H^{48}O^{4}$. It melts at 200° C., and sublimes apparently unchanged. Tonner (1866) met with it in the leaves of an Australian *Epacris*, a plant of the same order as the bearberry.

Lastly tannic acid is present in the leaves under notice; their aqueous infusion is nearly colourless, but assumes a violet hue on addition of ferrous sulphate. After a short time a reddish precipitate is produced, which quickly turns blue. By using ferric chloride, a bluish black precipitate immediately separates.

Adulteration—The leaves of *Vaccinium Vitis-idæa* L. called *Whortleberry* or *Cowberry*, have been confounded with those of bearberry, which in form they much resemble. But they are easily distinguished by being somewhat crenate toward the apex, dotted and reticulate on the under surface and more revolate at the margin.

Uses—An astringent tonic used chiefly in affections of the bladder.

EBENACEÆ.

FRUCTUS DIOSPYRI.

Botanical Origin—*Diospyros Embryopteris* Pers. (*Embryopteris glutinifera* Roxb.), a middle-sized or large evergreen tree, native of the western coast of India, Ceylon, Bengal, Burma, Siam and also Java.[2]

History—The tree, which has a Sanskrit name, was known to Rheede and was figured in his *Hortus Malabaricus*.[3] The circumstance that the unripe fruit abounds in an astringent viscid juice which is used by the natives of India for daubing the bottoms of boats, was communicated by Sir William Jones to Roxburgh in 1791. The introduction of the fruit into medicine which is due to O'Shaughnessy,[4] has been followed by its admission to the *Pharmacopœia of India*, 1868.

Description—The fruit is usually solitary, subsessile or peduncu-

[1] Gmelin, *Chemistry*, xvi. (1864) 28.

[2] A very complete account of the tree, as well as of the whole order, will be found in Hiern's *Monograph of Ebenaceæ*, published in the *Transactions of the Cambridge Philosophical Society*, xii. part i. 1873.

[3] Tom. iii. tab. 41.

[4] *Bengal Dispensatory*, Calcutta, 1842.

bular or ovoid, 1½ to 2 inches long, surrounded at the base by a d deeply 4-lobed calyx. It is of a yellowish colour, covered usty tomentum; internally it is pulpy, 6- to 10-celled, with thin ary seeds. The pulp is excessively astringent when unripe, but s quality at maturity so far as to become eatable. The fruit is y in the unripe and fresh state.

mical Composition—No satisfactory analysis has been made fruit, but there can be no doubt that in common with that of ecies of *Diospyros*, it is when immature, rich in tannic acid. in (1873),[1] who has examined the fruit of the American *D. ina* L., found it to contain a tannic acid which he considered with that of nutgalls, besides an abundance of pectin, glucose, ellow colouring matter insoluble in water but dissolving freely

s—The inspissated juice has been recommended as an astringent ıœa and chronic dysentery.

STYRACEÆ.

RESINA BENZOË.

inum; *Benzoin, Gum Benjamin*; F. *Benjoin*; G. *Benzoëharz*.[2]

anical Origin—*Styrax Benzoin* Dryander, a tree of moderate with stem as thick as a man's body and beautiful crown of indigenous to Sumatra and Java, in the first of which islands is produced.

tree yielding the superior benzoin of Siam, though commonly to this species, has never been examined botanically, and is unknown. The French expedition for the exploration of the and Cochin China (1866–68), reported the drug to be produced ıssia-yielding forests on the eastern bank of the river in question N. lat. 19°. Whether any benzoin is obtained from *S. Finlay-n* Wall, as conjectured by Royle, we know not.

tory—There is no evidence that the Greeks and Romans,[3] or earlier Arabian physicians, had any acquaintance with benzoin; he drug to be recognized among the commodities which were d to China by the Arab and Persian traders between the 10th h centuries, though the camphor of Sumatra is expressly named. first mention of benzoin known to us, occurs in the travels of uta,[4] who having visited Sumatra during his journey through , A.D. 1325–49, notes that the island produces *Java Frankincense* aphor. The word *Java* was at that period a designation of ı, or was even used by the Arabs to signify the islands and

sur le Plaqueminier (*Diospyros*), is, 1873. 28 30.

n in Malay and Javanese is termed *Kamiñan*, and *Kamayan*, abbre- *nāñan* and *miñan* (Crawfurd); it Siamese *kom-yan* or *kan-yan*; in *ān-si-hiāng*.

ne *Benzoin* is also applied to a crystalline substance obtained by treating Bitter Almond Oil with an alcoholic solution of potash. It has the formula $C^{14}H^{12}O^{2}$ (Schorlemmer).

[3] Crawfurd suggests that the *Malabathrum* of the ancients is possibly *benzoin*.—*Dict. of Indian Islands*, 50.

[4] *Voyages d'Ibn Batoutah*, traduit par Defrémery et Sanguinetti, Paris, 1853–59. iv. 228. 240.

productions of the Archipelago generally.[1] Hence came the A name *Lubán Jáwí*, i.e. *Java Frankincense*, corrupted into *'Ba Benjui, Benzui, Benzoë* and *Benzoïn*, and into the still more vi English *Benjamin*.

We have no further information about the drug until the latter of the following century, when we find a record that in 1461, the s of Egypt, Melech Elmaydi, sent to Pasquale Malipiero, doge of Ve a present of 30 *rotoli* of *Benzoi*, 20 *rotoli* of Aloes Wood, two pai Carpets, a small flask of Balsam (of Mecca), 15 little boxes of Ther 42 loaves of Sugar, 5 boxes of Sugar Candy, a horn of Civet, and 20 p of Porcelain.[2] Agostino Barberigo, another doge of Venice, was sented in a similar manner in 1490 by the sultan of Egypt with 35 of Aloes Wood, the same quantity of *Benzui* and 100 loaves of Su

Among the precious spices sent from Egypt in 1476 to Ca Cornaro, queen of Cyprus, were 10 ℔. of Aloes Wood and 15 *Benzui*.[4] These notices indicate the high value set upon the drug first brought to Europe.

The occurrence of benzoin in Siam is noticed in the journal o voyage of Vasco da Gama,[5] where in enumerating the kingdoms of I it is stated that Xarnauz (Siam[6]) yields much benzoin worth 3 *cru* and aloes worth 25 *cruzados* per *farazola*. According to the same re the price of benzoin (*beijoim*) in Alexandria was 1 *cruzado* per *ar* half the value of aloes wood.

The Portuguese traveller Barbosa visited in 1511, Calicut o Malabar Coast, and found *Benzui* to be one of the more valuable i of export, one *farazola* (22 ℔. 6 oz.) costing 65 to 70 *fanoes*; can fetched nearly the same price, and mace only 25 to 30 *fanoes*. other sources we gather that benzoin was an article of Venetian tra the beginning of the 16th century.

Garcia d'Orta, writing at Goa (1534–63), was the first to give a and intelligent account of benzoin, detailing the method of colle and distinguishing the drug of Siam and Martaban from that pro in Java and Sumatra.

In the early part of the 17th century, there was direct comm intercourse between England and both Siam and Sumatra, an E factory existing at Ayuthia (Siam) until 1623; and benzoin was d less one of the commodities imported. The import duties levied it in England in 1635, amounted to 10*s*. per ℔.[7]). Benzoic acid described as early as 1617 by Blaise de Vigenère.[8]

Production—Benzoin is collected in Northern and Eastern Su especially in the Batta country, lying southward of the state of A The tree grows in plenty also in the highlands of Palembang in the

[1] Yule, *Book of Ser Marco Polo*, ii. (1871) 228.

[2] Muratori, *Rerum Italicarum Scriptores*, xxii. (1733) 1170.—100 *rotoli* = 175 ℔. Avoirdupois.

[3] L. de Mas Latrie, *Hist. de l'île de Chypre*, etc. iii. (1861) 483.

[4] Ibid. iii. 406.

[5] *Roteiro da Viagem de Vasco da Gama em* 1497, par Herculano e o Barão Castello de Paiva, segunda edição, Lisboa, 1861. 109.

[6] Yule, *op. cit.* ii. 222.

[7] *The Rates of Marchandizes*, Lon.

[8] *Traicté du Feu et du Sel*, Paris, 1 There is said to be an edition of 160 we have not seen.

[9] Miquel, *Prodromus Flora Sum* 1860. 72; Marsden, *Hist. of Sumatra* 1783. 123.—The latter author resided coolen eight years, as an official of the Government. His specimens of ben now in the museum of the Pharma Society.

The statement of Crawfurd (*Dic*

d its resin is collected. It is chiefly on the coast regions that con-
lerable plantations are found. Teysmann saw the cultivation in the
cts of the river Batang Leko, the trees being planted about 15 feet
art. The benzoin from the interior is mostly from wild trees, which
cur at the foot of the mountains at an elevation of 300 to 1000 feet.

The trees, which are of quick growth, are raised from seeds sown on
e [edges of?] rice-fields; they require no particular attention beyond
ing kept clear of other plants, until about 6 or 7 years old, when
ey have trunks 6 to 8 inches in diameter, and are capable of yielding
e resin. Incisions are then made in their stems, from which there
udes a thick, whitish, resinous juice, which soon hardens by exposure
the air, and is carefully scraped off with a knife.

The trees continue to yield at the rate of about three pounds per
num for 10 or 12 years, after which period they are cut down. The
sin which exudes during the first three years, is said to be fuller of white
ars and therefore of finer quality, than that which issues subsequently,
d it is termed by the Malays *Head Benzoin*. That which flows during
e next 7 or 8 years, is browner in colour and less valuable, and is
own as *Belly Benzoin*; while a third sort called *Foot*, is obtained by
litting the tree and scraping the wood; this last is mixed with much
rk and refuse.[1]

Benzoin is brought for sale to the ports of Sumatra in large cakes
lled *Tampongs*, wrapped in matting. These have to be broken, and
tened either by the heat of the sun or by that of boiling water, and
en packed into square cases which the resin is made to fill.

The only account of the collection of *Siam Benzoin* is that given by
R. H. Schomburgk, for some years British Consul at Bangkok.[2] He
presents that the bark is gashed all over, and that the resin which
udes, collects and hardens between it and the wood, the former of
ich is then stripped off. This account is confirmed by the aspect of
me of the Siam benzoin of commerce as well as by that of pieces of
rk in our possession; but it is also evident that *all* the Siam drug is
t thus obtained. Schomburgk adds, that the resin is much injured
d broken during its conveyance in small baskets on bullocks' backs
the navigable parts of the Menam, whence it is brought down to
ngkok.[3]

Whether benzoin owes its original fluidity to a volatile oil holding
e resin in solution, and its solidification to the volatilization of this
, or whether the resin itself hardens by oxidation,—what occasions
e remarkable diversity of aspect between the opaque and milk-like,
d the completely transparent resin, are questions to be investigated by
e future observer.

Description—Benzoin (always termed in English commerce *Gum*

ian *Islands*, 1856. 50) that benzoin is col-
ed in Borneo "*on the northern coast in
erritory of Brunai*" is to us inexplicable.
Sir. John, British Consul in Borneo, in
ficial report on the trade of Brunai,
d from that place 29 January, 1858,
merates the various productions of the
ict, but does not name benzoin.

The terms *Head*, *Belly* and *Foot*, equi-
nt to our words *superior*, *medium* and
inferior, are used in the East to distinguish
the qualities of many other commodities, as
Borneo Camphor, Esculent Birds'-nests, Car-
damoms, Galbanum, &c.

[2] This account must have been derived
from others, for Sir R. H. Schomburgk cer-
tainly never visited the region producing
benzoin.

[3] *Pharm. Journ.* iii. (1862) 126.

Benjamin) is distinguished as of two kinds, *Siam* and *Sumatra*. Each sort occurs in various degrees of purity, and under considerable differences of appearance.

1. *Siam Benzoin*—The most esteemed sort is that which consists entirely of flattened tears or drops, an inch or two long, of an opaque, milk-like, white resin, loosely agglutinated into a mass. More frequently the mass is quite compact, consisting of a certain proportion of white tears of the size of an almond downwards, imbedded in a deep, rich amber-brown, translucent resin. Occasionally the translucent resin preponderates, and the white tears are almost wanting. In some packages, the tears of white resin are very small, and the whole mass has the aspect of a reddish-brown granite. There is always a certain admixture of bits of wood, bark, and other accidental impurities.

The white tears when broken, display a stratified structure with layers of greater or less translucency. By keeping, the white milky resin becomes brown and transparent on the surface, but from some experiments made by one of us (F.) it does not appear that the opacity is due to water, but rather to a peculiar molecular (semi-crystalline?) state of the resin.

Siam benzoin is very brittle, the opaque tears showing a slightly waxy, the transparent a glassy fracture. It easily softens in the mouth and may be kneaded with the teeth like mastich. It has a delicate balsamic, vanilla-like, fragrance but very little taste. When heated it evolves a more powerful fragrance, together with the irritating fumes of benzoic acid; its fusing point is 75° C. The presence of benzoic acid may be shown by the microscopical examination of splinters of the resin under oil of turpentine.

Siam benzoin is imported in cubic blocks, which take their form from the wooden cases in which they are packed while the resin is still soft.

2. *Sumatra Benzoin*—Prior to the renewal of direct commercial intercourse with Siam in 1853, this was the sort of benzoin most commonly found in commerce.

It is imported in cubic blocks exactly like the preceding, from which it differs in its generally greyer tint. The mass however, when the drug is of good quality, contains numerous opaque tears, set in a translucent, greyish-brown resin, mixed with bits of wood and bark. When less good, the white tears are wanting, and the proportion of impurities is greater. We have even seen samples consisting almost wholly of bark. In odour, Sumatra benzoin is both weaker and less agreeable than the Siam drug, and generally falls short of it in purity and handsome appearance,—and hence commands a much lower price.[1] The greyish-brown portion melts at 95°, the tears at 85° C.

A variety of Sumatra benzoin is distinguished by the London drug brokers as *Penang Benjamin* or *Storax-smelling Benjamin*. We have seen it of very fine quality, full of white tears (some of them two inches long), the intervening resin being greyish.[2] The odour is very agreeable and perceptibly different from that of Siam benzoin, or the usual Sumatra sort. Whether this drug is produced in Sumatra and by *Styrax Benzoin*

[1] In the *Public Ledger*, May 2, 1874, the prices are quoted thus:—Siam Gum Benjamin, 1st and 2nd qualities, £10 to £28 per cwt.; Sumatra, 1st and 2nd, £7 10s. to £[illegible]

[2] There were 8 cases of this drug offered at Public Sale, 13 April, 1871.

but it is worthy of note that *S. subdenticulatum* Miq. occurring Sumatra, has the same native name (*Kajoe Kĕminjan*) as *S.* d that Miquel remarks of it—"*An etiam benzoiferum?*"[1]

cal Composition—Benzoin consists mainly of amorphous ctly soluble in alcohol and in potash, having slightly acid and differing somewhat in their behaviour to solvents, whence been designated *alpha-resin, beta-resin*, &c. But they never-ear to agree in their essential properties. When benzoin is potash, it is partly decomposed and then according to Hlasi-Barth, yields among other products, protocatechuic acid (more cent.), para-oxybenzoic acid, $C^7H^6O^3$, and pyrocatechin.

ed to dry distillation, benzoin affords as chief product, *Benzoic* O^2, together with empyreumatic products, among which Ber-roved the presence (in Siam benzoin) of *Styrol* (p. 244). The d exists ready-formed to the extent of 14 to 18 or more per ough the acid readily dissolves in twelve parts of boiling esin in which it is imbedded, precludes its complete extraction ans. It is however easily accomplished by the aid of an st advantageously by milk of lime, which does not combine morphous resins.

is not manifestly acted on by bisulphide of carbon, but if tact with it for a month or two, very large colourless crystals acid make their appearance. Brought into a warm room, the ckly dissolve, but are easily reproduced by exposure to cold.

armacopœias require not the inodorous acid obtained by a wet that afforded by sublimation, which contains a small amount empyreumatic products. The resin when repeatedly subjected ion, affords as much as 14 per cent. of benzoic acid. It has nown that the opaque white tears of benzoin are less rich in d than the transparent brown resin in which they lie. From S. W. Brown (1833) extracted 13 per cent. of impure acid, he former scarcely 8½ per cent. We are by no means sure ifference is constant.

lmond oil, which by oxidation yields benzoic acid, is wanting Very little volatile oil is in fact to be got; half a pound Penang benzoin yielded us by distillation with water, only a f an extremely fragrant oil (*styrol?*).

chloride imparts to alcoholic solution of benzoin, a dark reen, which is not acquired under the same circumstances by decoction of the powdered resin: hence the reaction does from tannin. Benzoin dissolves in cold oil of vitriol, form-ion of splendid carmine hue, from which water separates benzoic acid.

nd Lautemann in 1860, discovered in Siam and Penang ben-er with benzoic acid, an acid of different constitution which in recognized as *Cinnamic Acid*, $C^9H^8O^2$. Aschoff (1861) found of Sumatra benzoin, cinnamic acid only, of which he got 11 and in amygdaloid Siam and Penang benzoin only benzoic ome samples of the latter, one of us (F.) has likewise met nic acid. On triturating this sort with peroxide of lead, and

[1] *Prod. Floræ Sumatranæ*, 1860. 474.

boiling the mixture with water, the odour of bitter-almond oil, due t the oxidation of cinnamic acid, is evolved.

The simultaneous occurrence of benzoic and cinnamic acids, or th absence of one or other of them in benzoin, is due to circumstances present unexplained.

Commerce—The statistics of Singapore,[1] the great emporium the commerce of the Indian Archipelago, show the imports of Gu Benjamin in 1871 as 7442 cwt., of which quantity 6185 cwt. had be shipped from Sumatra and 405 cwt. from Siam. Penang, which is al a mart for this drug, appears from the same authority to have receiv from Sumatra for trans-shipment, 4959 cwt. of Gum Benjamin.

Padang in Sumatra exported in 1870, 4303 piculs (5122 cwt.); a in 1871, 4064 piculs (4838 cwt.) of benzoin.[2]

The imports of Gum Benjamin into Bombay in the year 1871- were no less than 5975 cwt., and the exports 1043 cwt.[3]

Uses—Benzoin appears to be nearly devoid of medicinal propert and is but little employed. It is chiefly imported for use as incense the service of the Greek Church.

OLEACEÆ.

MANNA.

Manna; F. *Manne*; G. *Manna*.

Botanical Origin—*Fraxinus Ornus* L. (*Ornus Europæa* Pers.), Manna-ash, is a small tree found in Italy, whence it extends northwa as far as the Canton of Tessin in Switzerland and the Southern Ty It also occurs in Hungary (Buda) and the eastern coasts of the Adria in Greece, Turkey (Constantinople), in Asia Minor about Smyrna and Adalia on the south coast. It grows in the islands of Sicily, Sardi and Corsica, and is found in Spain at Moxente in Valencia.[4] As ornamental tree it has been introduced into Central Europe, where i often seen of greater dimensions, sometimes acquiring a height of ab 30 feet. It blossoms in early summer, producing numerous feath panicles of dull white flowers which give it a pleasing appearance. foliage exhibits great variation in shape of leaflets, even where the is uncultivated; and the fruits also are very diverse in form.

In some districts of Sicily, a little manna is obtained from Common Ash, *F. excelsior* L.

History—The name *Manna*, though originally applied to the alim miraculously provided for the sustenance of the ancient Israelites du their journey to the Holy Land, has been used to designate other stances of distinct nature and origin. Of these, the best known and i important is the saccharine exudation of *Fraxinus Ornus* L., which stitutes the *Manna* of European medicine.

From recent researches[5] it appears evident that previous to the

[1] *Blue Book* for the Colony of the Straits Settlements, Singapore, 1872.

[2] *Consular Reports*, August 1873, 953.

[3] *Statement of the Trade and Navigation of the Presidency of Bombay for* 1871-72. pt. ii. 26, 79.

[4] *Fraxinus Bungeana* DC., a tr Northern China, appears to be hardi tinct from *F. Ornus*.

[5] Hanbury, *Historical Notes on M Pharm. Journ.* xi. (1870) 326.

the manna used in Europe was imported from the East and was
; of the ash. Raffaele Maffei, called also Volaterranus, a writer
ırished in the second half of the 15th century, states that manna
o be gathered in Calabria in his time, but that it was inferior
oriental.[1] At this period, the manna collected was that which
spontaneously from the leaves of the tree, and was termed
di foglia or *Manna di fronda:* that which flowed from the stem
: name of *Manna di corpo* and was less esteemed. All such
was very dear.

ut the middle of the 16th century, the plan of making incisions
:unk and branches was resorted to, and although it was strenu-
pposed even by legislative enactment, the more copious supplies
t enabled the collectors to obtain, led to it being generally
. *Manna di foglia* became in fact utterly unknown, so that
f Naples writing in 1770, expresses doubt whether it ever had
ıtence.[2]

h regard to the history of manna-production in Sicily, there is
ious fact,—that near Cefalù there exists an eminence in the
ı range, called *Gibelman* or *Gibelmanna*, which in Arabic signifies
nountain. This name is not of modern origin, but is found in a
of the year 1082, concerning the foundation of the bishopric of
; and it has been held to indicate that manna was there col-
uring the Saracenic occupation of Sicily, A.D. 827 to 1070. We
. been successful in finding any evidence whether this supposition
ounded. On the other hand, it is remarkable that no writer, so
e know, mentions manna as a production of Sicily, before Paolo
of Palermo, who after naming many localities for the drug in
ıtal Italy, states that it is also obtained in Sicily.[3]

na was also produced until recently in the Tuscan Maremma,
her from that locality, nor from the States of the Church, where
ollected in the time of Boccone, is any supply now brought into
ce, though the name of Tolfa, a town near Civita Vecchia, is still
designate an inferior sort of the drug.

collection of manna in Calabria which was important up to the
he last century, has now almost entirely ceased.[4]

duction—The manna of commerce is collected at the present
lusively in Sicily. The principal localities producing the drug
listricts around Capaci, Carini, Cinisi, and Favarota, small towns
5 miles west of Palermo near the shores of the bay of Castel-
also the townships of Geraci, Castelbuono, and other places
istrict of Cefalù, 50 to 70 miles eastward of Palermo.

manna-ash, in the districts whence the best manna is obtained,
at the present day form natural woods, but is cultivated in regular
ns called *frassinetti.* The trees, which attain a height of from
feet, are planted in rows and stand about 7 feet apart, the soil
being at times loosened, kept free from weeds, and enriched by
After a tree is 8 years old and when its stem is at least 3 inches

entarii Urbani, Paris. 1515. lib.

Trans. lx. (1771) 233.

di Fisica, Venet. 1697. Obs.

[4] Hanbury in *Giornale Botanico Italiano*, Ottobre 1872. 267; *Pharm. Journ.* Nov. 30. 1872. 421.

in thickness, the gathering of manna may begin; and may co for 10 or 12 years, when the stem is usually cut down, and a you brought up from the same root takes its place. The same stum has often two or three stems rising from it.

To obtain manna, transverse cuts from 1½ to 2 inches long and apart, are made in the bark, just reaching to the wood. One cut is daily, beginning at the bottom of the tree, the second directly abo first, and so on while dry weather lasts. In the following year, cu made in the untouched part of the stem, and in the same w succeeding seasons. When after some years, the tree has been c round and is exhausted, it is felled. Pieces of stick or straws are in in the incisions, and become encrusted with the very superior m called *Manna a cannolo,* which however, is unknown in commerc special sort. The fine manna ordinarily seen, appears to have har on the stem of the tree. The manna which flows from the lower inci and is often collected on tiles or on a cup-shaped piece of the st the prickly pear (*Opuntia*), is less crystalline, and more gumm glutinous, and is regarded of inferior quality.

The best time for notching the stems is in July and August, the trees have ceased to push forth more leaves. Dry and warm w is essential for a good harvest. The manna after removal fro tree, is laid upon shelves in order that it may dry and harden it is packed. The masses left adhering to the stem after the finer have been gathered, are scraped off and form part of the *Small M* of commerce.[1]

Secretion—We have examined microscopically the bark of st *Fraxinus Ornus* that had been incised for manna at Capaci. It ex no peculiarity explaining the formation of manna, or any evidenc the saccharine exudation is due to an alteration of the cell-walls the case of tragacanth. The bark is poor in tannic matter; it co starch, and imparts to water a splendid fluorescence due to the pr of *Fraxin.*

Description — Various terms have been used by pharmacol writers to designate the different qualities of manna, but in E commerce they are not now employed; and the better kinds c drug are called simply *Flake Manna,* while the smaller pieces, u loosely agglutinated and sold separately, are termed *Small Man Tolfa Manna.*

Owing to the gradual exudation of the juice and the deposi one layer over another, manna has a stalactitic aspect. The finest are mostly in the form of three-edged sticks, sometimes as much to 8 inches long and an inch or more wide, grooved on the inne which is generally soiled by contact with the bark; of a porous, c line, friable structure and of a pale brownish yellow tint, bec nearly pure white in those parts which have been most distant fro bark of the tree. The pieces which are of deeper colour and unctuous or gummy appearance, are less esteemed. Good manna i

[1] Our account of the production of manna has been derived from the observations of Stettner, who visited Sicily in the summer of 1847 (*Archiv der Pharm.* iii. 194; also Wiggers' *Jahresbericht,* 1848. 35; *Hooker's Journ. of Bot.* i. 1849. 124), from Cleghorn (*Trans. of the Bot. Soc. burgh,* x. 1868–69. 132), and from investigations made by one of us neighbourhood of Palermo in May 1

nd brittle, and melts in the mouth with an agreeable, honey-like sweetness, not entirely devoid of traces of bitterness and acridity. Its odour may be compared to that of honey or moist sugar.

Manna of the best quality dissolves at ordinary temperatures in about six parts of water, forming a clear, neutral liquid. It contains besides mannite, a small proportion of sugar and gum.

The manna which exudes from the older stems and from the lower parts of even young trees, contains more or less considerable quantities of gum and fermentable sugar, as well as extraneous impurities. The less favourable weather of the later summer and autumn promotes an alteration in the composition of the juice, and impairs its property of concreting into a crystalline mass.

Chemical Composition—The predominant constituent of manna, at least of the better sorts, is *Manna-sugar* or *Mannite*, $C^6H^{14}O^6$, which likewise occurs, though in much smaller quantity, in many other plants besides *Fraxinus*. Artificially, it is produced by treating glucose, $C^6H^{12}O^6$, with sodium-amalgam, and indirectly in the fermentation of glucose or of cane-sugar. It is isomeric with dulcite or melampyrin; crystallizes in shining prisms or tables, belonging to the rhombic system; melts at 165° C., and in very small quantity may by careful heating, be sublimed undecomposed. It dissolves in 6 parts of water at ordinary temperature, less freely in aqueous alcohol, very sparingly in absolute alcohol, and not in ether. The solution has an extremely weak rotatory power, and is not altered by boiling with dilute acids or alkalis, or with alkaline cupric tartrate.

Berthelot has shown that mannite is susceptible of fermentation, though not so easily as sugars belonging to the group of carbo-hydrates. When mixed with moist platinum-black, it becomes very hot, and yields uncrystallizable *Mannitic Acid*, $C^6H^{12}O^7$, and *Mannitose*, $C^6H^{12}O^6$, a kind of sugar resembling grape-sugar and probably isomeric therewith, but optically inactive and not yet shown to be crystallizable.

With nitric acid, mannite yields neither tartaric nor mucic acid, but sugar together with a certain quantity of racemic acid. By dry distillation, it affords acrolein, formic acid and other products. All the chemical reactions of mannite show it to belong to the class of alcohols, and among these it is most nearly related to glycerin. The quantity of mannite in the best manna varies from 70 to 90 per cent.

When a solution of manna is mixed with alkaline cupric tartrate, rapid reduction to cuprous hydrate takes place even in the cold. This effect is due to the presence of a sugar which, according to Backhaus, consists of ordinary dextro-glucose. It may amount to as much as 16 per cent., and is found in the best flake manna, but most abundantly in the unctuous varieties. Buignet[1] has pointed out that the rotatory power of this sugar being inconsiderable, it probably consists of a mixture of *Cane-sugar* and *Levulose*. He found however that an aqueous solution of manna deviates powerfully to the right, a fact which he considers due to the presence of a large proportion of *Dextrin*. The best kinds of manna, according to Buignet, contain about 20 per cent. of dextrin; the inferior much more. With nitric acid, the dextrin

[1] *Journ. de Pharm.* vii. (1867) 401; viii. (1868) 5.

does not furnish mucic acid; its solution is not precipitated even basic acetate of lead, but is thrown down by alcohol.

In our experiments, we have not succeeded in isolating either dex or cane-sugar. There is present, even in the finest manna, a s amount of a dextrogyre mucilage, which is precipitated by neutral ac of lead and yields mucic acid when boiled with concentrated nitric

Ether extracts from an aqueous solution of manna a very s quantity of red-brown resin, having an offensive odour and sub-a taste; together with traces of an acid which reduces silver-salts appears to be easily resinified. The quantity of water in the inf kinds of manna often amounts to 10 or 15 per cent. The finest ma affords about 3·6 per cent. of ash.

The greenish colour of certain pieces of manna was formerly a buted to the presence of copper, till Gmelin on account of the fl escence of the solution, ascribed it to *Æsculin*. It is in reality prod by a body much resembling æsculin, namely *Fraxin*, $C^{16}H^{18}O^{10}$, occur in the bark of the manna-ash and of the common ash, and toge with æsculin, in that of the horse-chestnut. Fraxin crystallize colourless prisms, easily soluble in hot water and in alcohol, and ha a faintly astringent and bitter taste. By dilute acids, it is reso into *Fraxetin*, $C^{10}H^{8}O^{5}$, and *Glucose*, $C^{6}H^{12}O^{6}$. The presence of fr in manna, especially in the inferior sorts, is made apparent by the f fluorescence of the alcoholic manna solution.

Commerce—The exports of manna from Sicily[1] (chiefly f Palermo) have been as follows:—

1869	1870	1871
2546 cwt., val. £15,972.	1564 cwt., val. £10,220.	3038 cwt., val. £19,528

About half the quantity is sent to France. Italian commercial statis represent the export of manna in 1870 thus:—*in cancelli* 58,691 (1155 cwt.), *in sorte* 186,664 kilo. (3676 cwt.) The United King imported in the year 1870, 230 cwt. of manna, valued at £4447.[3]

Adulteration—It can hardly be said that manna is subje adulteration, though attempts to introduce a spurious manna ma glucose have been recorded. But considerable skill and ingenuity been expended in converting the inferior sorts of manna into wha the aspect of fine natural Flake Manna, the manufacturers admi however the factitiousness of their product. The artificial Flake M has the closest superficial resemblance to very fine pieces of the na drug, but differs in its more uniform colour, and in being uncontamin with the slight impurities, from which natural manna is never wl free. It differs also in that when broken, no crystals of mannite a be seen in the interstices of the pieces, and it wants the peculiar o and slightly bitter flavour of natural manna. If one part of it is b with four of alcohol (·838), a viscid honey-like residue will be obta whereas natural manna leaves undissolved a hard substance. Hi

[1] *Report by Consul Dennis on the Commerce and Navigation of Sicily in* 1869, 1870 *and* 1871.

[2] Direzione generale delle Gabelle—*Movimento commerciale del regno d'Italia nel* 1870, Milano 1871.

[3] *Annual Statement of the Trade and Navigation of the U.K. for* 1870. p. 1

[4] *On artificial Flake Manna*, in *P Journ.* xi. (1870) 629.

und it to afford about 40 per cent. of mannite, while fine manna milarly treated yielded 70 per cent.

Uses—A gentle laxative, much less frequently employed in this untry than formerly, but still largely consumed in South America. annite which possesses similar properties, is often prescribed in Italy.

Other sorts of Manna.

Various plants besides *Fraxinus* afford under certain conditions, ccharine exudations some of which constituted the *Oriental Manna* ed in Europe in early times. So far as is known, they differ from ficinal manna in containing no mannite.

Alhagi Manna: *Turanjabín* (Arabic); is afforded by *Alhagi Camerum* Fisch., a small spiny plant of the order *Leguminosæ* found in ersia, Afghanistan and Beluchistan. Excellent specimens of the anna, kindly obtained for us in the north-west of India by Dr. E. arton Brown and Mr. T. W. H. Tolbort, show it as a substance in little undish, hard, dry tears, varying from the size of a mustard-seed to at of a hemp-seed, of a light brown colour, agreeable saccharine taste, d senna-like smell. According to Ludwig[1] it contains crystalline ars or grains of cane-sugar, some dextrin, a sweetish mucilaginous bstance and a very little starch. The leaflets, spines and pods of the ant, mixed with the grains of this manna, are characteristic and easily cognizable.

Alhagi Manna is collected near Kandahar and Herat, where it is and on the plants at the time of flowering. It is imported into India om Kabul and Kandahar to the extent of about 25 *maunds* (2000 lb.) nually; its value is reckoned at 30 rupees per *seer*, = 30*s*. per lb.[2]

Gaz-anjabín (Arabic): ***Tamarisk Manna*** (in part). In the nths of June and July, the shrubs of tamarisk (*Tamarix gallica* var. *annifera* Ehrenb.) growing in the valleys of the peninsula of Sinai, pecially in the Wady es Sheikh, exude from their slender branches, consequence of the puncture of an insect (*Coccus manniparus* Ehrenb.) tle honey-like drops, which in the coolness of early morning are found a solid state. This substance is *Tamarisk Manna*: it is collected by n Arabs, and by them sold to the monks of St. Katharine, who dispose it to the pilgrims visiting the convent. Tamarisk Manna is also proced (but is perhaps no longer collected?) in Persia, where it is called *z-angabín*;[3] and probably likewise in the Punjab,[4] from which regions may have been brought to Europe in ancient times.

A specimen of tamarisk manna brought from Sinai, examined in 61 by Berthelot, had the appearance of a thick yellowish syrup, conminated with vegetable remains. It was found to consist of canegar, inverted sugar (levulose and glucose), dextrin and water, the last stituting one-fifth of the whole.[5]

Although the name *Gaz-angabín* signifies *tamarisk-honey*, it is used ording to Haussknecht[6] at the present time in Persia, to designate

[1] *Archiv der Pharmacie*, 193 (1870) 32–52.
[2] Stewart, *Punjab Plants*, Lahore (1869) 57; Davies, *Report on the trade and resources of the countries on the N.W. boundary of British India*, Lahore, 1862.
[3] Angelus, *Pharm. Persica* (1681) 359.
[4] Stewart, *op. cit.* p. 92.
[5] *Comptes Rendus*, liii. (1861) 583; *Pharm. Journ.* iii. (1862) 274.
[6] *Archiv d. Pharmacie*, 192 (1870) 246.

certain round cakes, common in all the bazaars, of which the chief co stituent is a manna collected in the mountain districts of Chahar-Mal and Faraidan, and especially about the town of Khonsar, south-w of Ispahan, from *Astragalus florulentus* Boiss. et Haussk. and *adscendens* Boiss. et Haussk. The best sorts of this manna, whi are termed *Gaz Alefi* or *Gaz Khonsari*, are obtained in August shaking it from the branches, the little drops finally sticking togeth and forming a dirty, greyish-white, tough mass. The commoner s got by scraping the stem, is still more impure. The specimen of brought by Haussknecht yielded to Ludwig[1] dextrin, uncrystallizal sugar and organic acids.

Shír-khisht—Ancient writers on materia medica as Garcia d'O (1563) mention a sort of manna known by this name. The substance still found in the bazaars of North-western India, being imported small quantity from Afghanistan and Turkistan.[2] Haussknecht in l paper on Oriental Manna already quoted, states that it is the exudation *Cotoneaster nummularia* Fisch. et Mey. (*Rosaceæ*), also of *Atrapha spinosa* L. (*Polygonaceæ*), and that it is brought chiefly from Herat. I have to thank Dr. E. Burton Brown of Lahore, and Mr. Tolbort for spe mens of this manna, which, from fragments it contains, is without do derived from a *Cotoneaster*. It is in irregular roundish tears, from abou up to ¾ of an inch in greatest length, of an opaque dull white, sligh clammy, and easily kneaded in the fingers. It has a manna-like sm a pure sweet taste and crystalline fracture. With water, it forms syrupy solution with an abundant residue of starch granules.

Shír-khisht was found by Ludwig to consist of an exudation ana gous to tragacanth, but containing at the same time two kinds of g an amorphous levogyre sugar, besides starch and cellulose.

Oak Manna—The occurrence of a saccharine substance on the is noticed by both Ovid and Virgil, and it is also mentioned by Arabian physicians, as Ibn Baytar[3] and Elluchasem Elimithar.[4] last named who died A.D. 1052, states that the exudation appears u the oaks in the region of Diarbekir. At the present day, it is the of some industry among the wandering tribes of Kurdistan, who acc ing to Haussknecht, collect it from *Quercus Vallonea* Kotschy and *Persica* Jaub. et Spach. These trees are visited in the month of Au by immense numbers of a small white *Coccus*, from the puncture which a saccharine fluid exudes, and solidifies in little grains. people go out before sunrise, and shake the grains of manna from branches on to linen cloths, spread out beneath the trees. The exud is also collected by dipping the small branches on which it is ter into vessels of hot water, and evaporating the saccharine solution a syrupy consistence, which in this state is used for sweetening food is mixed with flour to form a sort of cake.

A fine specimen of the Oak Manna of Diarbekir was sent to London International Exhibition of 1862. It constituted a mass of agglutinated tears, much resembling an inferior sort of manna, and had an agreeable saccharine taste

[1] l. c.

[2] Davies in the work quoted at page 371, note 2.

[3] Ed. Sontheimer, Bd. i. 375.

[4] *Tacuini Sanitatis*, Argent. (155

pure form of this manna occurs as a compact, greyish, saccha-
sometimes hard enough to be broken with a hammer. It
sugary matter, mixed with abundance of small fragments of
s, and has a herby smell and pleasant sweet taste. A sample
it from Diarbekir examined by one of us, yielded 90 per cent.
re sugar, which could not be obtained in a crystalline state,
xists in such condition in the crude drug. Starch and dextrine
ly wanting.[1]

imen furnished to Ludwig[2] by Haussknecht afforded much
small amount of starch, about 48 per cent. of dextrogyre
, with traces of tannic acid and chlorophyll.

on Manna—This is a white saccharine substance which in
of summer and in the early part of the day, is found adhering
ndance to the leaves of the larch (*Pinus Larix* L.), growing
ntains about Briançon in Dauphiny. It was formerly collected
edicine, but only to a very limited extent, for it was rare in
e time of Geoffroy (1709–1731), and at the present day has
peared from trade, though still gathered by the peasants. A
llected for one of us near Briançon in 1864, consists of small,
paque, white tears, many of them oblong and channelled, and
the needle-like leaf of the larch; they have a sweet taste and
. Under the microscope they exhibit indistinct crystals.

n manna has been examined by Berthelot, who detected in it
ugar termed *Melezitose*.[3]

other saccharine exudations have been observed by travellers
ists; but as most of them are unknown to us, we shall simply
he more remarkable, referring the reader for further informa-
original notices.

ahra Boiss. affords in Luristan a substance which, according
echt, is collected by the inhabitants, and is extremely like
. It is stated by the same traveller that *Salix fragilis* L.,
alacia frigida Boiss., likewise yield in Persia saccharine
A kind of manna was anciently collected from the cedar,
is L.[4] Manna is yielded in Spain by *Cistus ladaniferus* L.[5]
Manna, which is in small rounded, opaque, white, dry
ound on the leaves of *Eucalyptus viminalis* Labil. It con-
d of sugar called *Melitose*,[6] has a sweet taste, is devoid of
roperties and is not collected for use.[7]

stance named *Tigala* (corrupted into *Trehala*), from which a
gar has been obtained,[8] is the cocoon of a beetle, and not
accharine exudation.[9]

Manna of Australia is also of animal origin.[10] It consists

[1] Pharmacopœia, see Flückiger, [illegible] Kirchner, in [illegible], 200 (1872) 159.

[2] [illegible], xv. 298; *Journ. de* (1858) 292.

[3] *Ann. Mich.* ii. (1741) 584. [illegible] (1780) [illegible], xv. 296. [illegible], iv. (1863) 108.

[4] *Comptes Rendus*, xlvi. (1858) 1276; Guichin, *Chem. Stud.*, xv. 299.

[5] Belon, *Singularités* (1554) l. 2. cap. 91; Guibourt, *Comptes Rendus*, 21 Juin 1858, p. 1213; Hanbury, *Journ. Linn. Soc.*, Zoology, iii. (1859) 178.

[6] Dobson, *Proceedings of Royal Society of Van Diemen's Land*, i. (1851) 234; *Pharm. Journ.* iv. (1863) 108; Flückiger, *Wittstein's Vierteljahrsschr.* xvii. (1868) 161; *Archiv der Pharmacie*, 196 (1871) 7; abstracted in the *Year-book of Pharmacy*, 1871. 188.

of water 14, white threadlike portion 33, sugar 53 parts. The thre possess some of the characteristic properties of starch, from which t differ entirely by their form and unalterability even in boiling wa Yet in sealed tubes, they dissolve in 30 parts of water at 135 The sugar is dextrogyre; it impregnates the threads as a soft br amorphous mass. In the purified state it does not crystallize, e after a long time. By means of dilute sulphuric acid, the threads converted into crystalline grape-sugar.

OLEUM OLIVÆ.

Olive Oil; Salad Oil; F. *Huile d'Olives;* G. *Olivenöl; Baumöl; Provencer Oel.*

Botanical Origin—*Olea Europæa* L., an evergreen tree, sel exceeding 40 feet in height yet attaining extreme old age, abunda cultivated in the countries bordering the Mediterranean, up to an el tion of about 2000 feet above the sea-level.[1] *O. cuspidata* Wall, a abundant in Afghanistan, Beluchistan and Western Sind, has been posed to be a wild form of *O. Europæa*, but is regarded by Brandi a distinct species. It is not known to have been ever cultivated its fruit which is of small size and but sparingly produced, is capal affording a good oil.

History—According to the elaborate investigations of Ritter[3] a A. De Candolle,[4] there can be no doubt that the olive-tree is a nati Palestine, and perhaps of Asia Minor and Greece. Schweinfurth[5] re it as undoubtedly wild on the mountains of Elbe and Soturba in l N. on the western shores of the Red Sea, a locality which he visit 1868. The olive would appear to have been introduced at a very re period into Northern Africa and Spain. It was plentiful in the naica as early as the time of Theophrastus, 3rd century B.C.

At the present day, it is largely cultivated in Algeria, Spain, Por Southern France, Italy, the Greek Peninsula and Asia Minor. I Crimea, the tree grows well, but does not afford good fruit. I carried to Lima in Peru about 1560 and still flourishes there in great plenty in the coast valleys further south as far as Sa in Chili.[6]

Olive oil is mentioned in the Bible so frequently that it must been an important object with the ancient Hebrews. It held an eq prominent place among the Greeks and Romans,[7] whose write agriculture and natural history treat of it in the most circumst manner. Olive fruits preserved in brine were used by the Rom

[1] Grisebach states the elevation above the sea of olive-cultivation thus:—Portugal (Algarve) 1400 feet; Sierra Nevada 3000; do., southern slope 4200; Nice 2400; Etna 2200; Macedonia 1200; Cilicia 2000. *Die Vegetation der Erde nach ihrer klimatologischen Anordnung*, i. (1872) 262, 283, 342.

[2] *Forest Flora of North-western and Central India*, 1874.

[3] *Erdkunde von Asien*, vii. (part 2. 1844) 516-537.

[4] *Géographie Botanique* (1855) 912.

[5] *Bot. Zeitung*, 1868, 860.

[6] Perez-Rosales, *Ensai sur le Chili*, bourg, 1857, 133.

[7] Hehn, *Kulturpflanzen und Haustiere in ihrem Uebergange aus Asien nach Griechenland und Italien*, Berlin, 1870, 44-5 interesting account of the importance olive in ancient times.

of food, and were an object of commerce with Northern Europe
s the 8th century.[1]

uction—In common with many important cultivated plants,
occurs under several varieties differing more or less from the
n, the finer of which are propagated by grafting. It is also
by the suckers which old trees throw up from their naked
which are easily made to develope into separate plants.[2] The
val drupe, half an inch to an inch or more in length, and of a
le, is remarkable for the large amount of fat oil contained in
portion (sarcocarp). The latter is most rich in oil when ripe,
g then nearly 70 per cent., besides 25 per cent. of water. The
it as well as other parts of the plant, abounds in mannite,
appears in proportion as the oil increases. The ripe olive con-
nannite, it having probably been transformed into fatty oil.[3]
rocess for extracting olive oil varies slightly in different countries,
ts essentially in subjecting the crushed pulp of the ripe fruit
te pressure. The olives, which are gathered from the trees, or
from the ground, in November, or during the whole winter and
ng, are crushed under a millstone to a pulpy mass. This is
into coarse bags, which, piled upon one another, are subjected
te pressure in a screw-press. The oil thus obtained, is conducted
or cisterns containing water, from the surface of which it is
with ladles. This is called *Virgin Oil.* After it has ceased to
ontents of the bags are shovelled out, mixed with boiling water,
itted to stronger pressure than before, by which a second
oil is got. If the fruit is left for a considerable time in heaps
es decomposition, yielding by pressure a very inferior quality
ed in French *Huile fermentée.* The worst oil of all, obtained
residues, has the name of *Huile tournante* or *Huile d'enfer.*
aid that in some districts, the millstones are so mounted as to
pulp without breaking the olive-stones, and that thus the oil
lp is obtained unmixed with that of the kernels.[4] We have
y inquiries in Italy and France as to this method of oil-making,
t find that it is anywhere followed.
xed oil of the kernels of ripe olives has been extracted and
by one of us (F.) Though the kernels have a bitterish taste,
ey yield is quite bland; by exposure to the vapour of hypo-
l, it concretes like that of the pulp. If the whole of it were
in making olive oil, it would only be about as 1 part of oil
seed, to 40 parts of oil of the *pulp.*

ription—Olive Oil is a pale yellow or greenish yellow, some-
id liquid, of a faint agreeable smell and of a bland oleaginous
ing in the throat a slight sense of acridity.[5] Its specific gravity
rage is 0·916 at 17·5 C. In cold weather, olive oil loses its

[1] ...of Chilperic, A.D. 716. Par-
... *Paris*, ...

[2] ...in *Pharm. Journ.* Sept. 7, 1872.
... in *Journ. de Pharm.* xlv. (1863)
...ther research by Hanbury on the
...olive oil may be found in Witt-
...*Jahresschrift für prakt. Pharm.*
...61.

[4] *The Chemist*, April 25, 1868, supplement;
Pereira, *Elements of Mat. Med.* ii. (1850) 1505.

[5] This according to our experience is the
case even with oil as it runs from the pulp
and therefore in the freshest condition; but
the acrid after-taste is more perceptible in
oil which has been kept.

transparency by the separation of a crystalline fatty body. The de sition takes place at a few degrees above the freezing point of wa and in some oils even at 10° C. (50° F.) If the oil is allowed to c geal perfectly, and is then submitted to strong pressure, about o third of its weight of solid fat may be separated. After repea crystallizations, this fat melts at 20 to 28° C. The fluid part or *Ole* continues fluid at – 4° to – 10° C. Olive oil belongs to the class of t less alterable, non-drying oils.

The foregoing description does not apply to the inferior sorts of which congeal more easily, are more or less deep-coloured, have a d agreeable odour and taste, and quickly turn rancid. These inferior o have their special applications in the arts.

Chemical Composition—The chief constituent of olive oil is *Ol* or more correctly *Triolein*, $C^3H^5O^3$, $3\,C^{18}H^{33}O$, identical so far as present ascertained, with the fluid part of all oils of the non-dri class. The proportion of olein in olive oil, as well as in other o is liable to variation, the result partly of natural circumstances partly of the processes of manufacture. The best oils are comparativ rich in olein.

As to the solid part of olive oil, Chevreul believed it to be constitu of *Margarin*, which he first examined in 1820. But Heintz (1852 later) showed margarin to be a mixture of palmitin with other compou of glycerin and fatty acids. Collett in 1854 isolated *Palmitic A* $C^{16}H^{32}O^2$, from olive oil; and Heintz and Krug (1857) further pro that *Tripalmitin* is the chief of the solid constituents of olive oil. T also met with an acid melting at 71·4° C., which they regarded *Arachic Acid* (p. 164). As to stearic acid, Heintz and Krug did fully succeed in evidencing its presence in olive oil.

Lastly, Benecke discovered in olive oil a small quantity of *Chol* $C^{26}H^{44}O$. It may be removed by means of glacial acetic acid or alc which dissolve but very little of the oil.

Commerce—Various sorts of olive oil are distinguished in English market, as Florence, Gallipoli, Gioja, Spanish (Malaga Seville), Sicily, Myteline, Corfu and Mogador.

Olive oil was imported into the United Kingdom in the year 1 to the value of £1,193,064. Nearly half the quantity was shipped f Italy, one-fifth from Spain, and the remainder from other Mediterr countries.

The average annual production in Italy is estimated at upw of 1,500,000 hectolitres (33 million gallons), representing a valu £8,000,000 sterling, but the quantity exported does not exceed in v £2,800,000.[1]

The statistics of the French Government indicate the annual duction of olive oil in France to be not more than 250,000 hecto equivalent in value to 30 millions of francs (£1,200,000).[2]

Uses—The uses of olive oil in medicine and its immense cons tion in the warmer parts of Europe as an article of food, are too known to require more than a passing allusion.

[1] *Journ. of Soc. of Arts*, May 22, 1868.

[2] Exposition de 1867 à Paris, *Rapp. Jury International*, xi. 108.

eration—Olive Oil is the subject of various fraudulent s with less costly oils, the means of detecting which has much attention. Of the various methods by which chemists avoured to ascertain the purity of olive oil, the following are noteworthy :—

Drying oils (such as the oils of poppy and walnut) may be dised by their not being converted into solid crystallizable elaidin nitric acid or concentrated solution of nitrate of protoxide of . Olive oil which contains any considerable proportion of hese oils, no longer solidifies if exposed for a moment to one above-mentioned reagents. This test however is not of sufelicacy for small amounts of drying oils.

Olive oil being one of the lighter oils, the specific gravity may degree indicate admixture with a heavier oil. To make use fact, Gobley and other chemists have invented an instrument *elaiometer*, for taking the specific gravity of oils.

Olive oil, when mixed with concentrated sulphuric acid, sets caloric than many other oils similarly treated. An exact on of the amount of caloric, requires a thorough proficiency ical experiments, so that in a practical point of view this of testing is of no great utility.

Observation of the Cohesion-figure.—This test, proposed by on in 1864,[1] depends on the forces of cohesion, adhesion, usion. Thus, if a drop of any oil hanging from the end of a d is gently deposited upon the surface of chemically clean contained in a clean glass, a contest takes place between es in question the moment the drop flattens down by its upon the surface of the water. The adhesion of the liquid ends to spread out the drop into a film, the cohesive force of icles of the drop strives to prevent that extension, and the of these forces is a figure which Mr. Tomlinson believes to ite for every independent liquid. The figure thus produced l the *cohesion-figure*. A series of careful and patient experiith materials of known purity, is requisite in order to ascerpractical applicability of this method of testing as applied to . From the woodcuts given by Mr. Tomlinson, there is, we much hope of it being effectual for the detection of sesamé ss the latter be in very large proportion.

As our experience goes, the processes hitherto recommended olive oil (and there are several that we have not mentioned) vailable in cases where the adulteration is considerable, and nsufficient for discovering a small admixture of other oils. they are appreciated, may be inferred from the fact that the f Commerce of Nice[2] has recently offered a reward of 15,000 00) for a simple and easy process for making evident an adth olive oil of 5 per cent. at least, of any seed-oil.

[1] *Pharm.* v. (1864) 387, 495, with

[2] *Annales de Chimie et de Physique*, March, 1869, 309.

APOCYNEÆ.

CORTEX ALSTONIÆ.

Cortex Alstoniæ scholaris; Alstonia Bark.

Botanical Origin—*Alstonia*[1] *scholaris* R. Brown (*Echites sc* L.), a handsome forest tree, 50 feet or more in height, common thro the Indian Peninsula from the sub-Himalayan region to Ceylc Burma; found also in the Philippines, Java, Timor and Eastern Au likewise in Tropical Africa. It has oblong obovate leaves, in wh 5 to 7, and slender pendulous pods a foot or more in length.

History—Rheede[2] in 1678 and Rumphius[3] in 1741 describ figured the tree, and mentioned the use made of its bark by the practitioners. Rumphius also explained the trivial name *schol* referring to slabs of the close-grained wood which are used as s slates, the letters being traced upon them in sand. The tonic pro of the bark were favourably spoken of by Graham in his *Catal Bombay Plants* (1839), and further recommended by Dr. Ale Gibson in 1853.[4] The drug has a place in the *Pharmacopœia of* 1868.

Description—The drug, as presented to one of us by the la Gibson and by Mr. Broughton of Ootacamund, consists of in fragments of bark, $\frac{1}{8}$ to $\frac{1}{2}$ an inch thick, of a spongy texture, breaking with a short, coarse fracture. The external surface i uneven and rough, dark grey or brownish, sometimes with blackish the interior substance and inner surface (liber) is of a bright bu transverse section shows the liber to be finely marked by numerous medullary rays. The bark is almost inodorous; its taste is purely and neither aromatic nor acrid.

Microscopic Structure—The cortical tissue is covered with suberous coat; the middle layer of the bark is built up of a thin parenchyme, through which enormous, hard, thick-walled cells are tered in great numbers and are visible to the naked eye, as they large irregular groups of a bright yellow colour. Towards the inne these stone-cells disappear, the tissue being traversed by und medullary rays, loaded with very small starch grains; many of the parenchymatous cells of the liber contain crystals of calcium o The longitudinal section of the liber exhibits large but not very nu laticiferous vessels, as elongated simple cells with perforated tra walls (sieve-cells), containing a brownish mass, the concrete milk-ju which all parts of the tree abound.

Chemical Composition—Gruppe,[5] a pharmacien of Manil obtained from the bark an uncrystallizable bitter substance which h *Ditaïn*[6] and to which he ascribes the febrifuge powers of the drug.

From the chemical examination of the bark of an allied Aus tree, *Alstonia constricta* F. v. Müller, it may be presumed that the

[1] So named in honour of Charles Alston, Professor of Botany and Materia Medica (1740–1760) in the University of Edinburgh.

[2] *Hortus Malabaricus*, i. tab. 45.

[3] *Herb. Amboin.* ii. tab. 82.

[4] *Pharm. Journ.* xii. (1853) 422.

[5] *Zeitschrift d. Oesterreich. Apoth.* 1873. 249.

[6] From *Dita*, the name of the tree in the island of Luzon.

nce of *A. scholaris* is not an alkaloid. The Australian bark analysed m in Wittstein's laboratory,[1] yielded an amorphous resinous bitter soluble in alcohol but very sparingly in ether or water, an al oil of camphoraceous odour, and tannic matter striking a green th salts of iron. Palm ascertained that the bitter principle is not asic nature. The Australian bark, a specimen of which has been ted to us by Dr. Wittstein, is quite different from that of *A.* is in its structural characters.

ses—The bark has been recommended as a tonic and antiperiodic: s not yet been employed in Europe.[2]

ASCLEPIADEÆ.

RADIX HEMIDESMI.

Hemidesmus Root, Nunnari Root, Indian Sarsaparilla.

otanical Origin—*Hemidesmus indicus* R. Brown (*Periploca indica* , *Asclepias Pseudo-sarsa* Roxb.), a twining shrub, growing throughe Indian Peninsula and in Ceylon. The leaves are very diverse, narrow and lanceolate in the lower part of the plant and broadly in the upper branches.

istory—The root under the name of *Nannárí* or *Ananto-múl* has een employed in medicine in the southern parts of India.[3] Ash- in 1831, was the first to call the attention of the profession in e to its medicinal value.[4] In 1864 it was admitted to a place in *ritish Pharmacopœia*, but its efficiency is by no means generally wledged.

escription[5]—The root is in pieces of 6 inches or more in length; rlindrical, tortuous, longitudinally furrowed, from $\frac{5}{10}$ to $\frac{7}{10}$ of an n thickness, mostly simple or provided with a few thin rootlets, ng slender, branching, woody aerial stems, $\frac{3}{10}$ of an inch or less Externally it is dark brown, sometimes with a slight violet-grey which is particularly obvious in the sunshine. The transverse n of the hard root, shows a white mealy or brownish or somewhat cortical layer, not exceeding $\frac{1}{10}$ of an inch in thickness, and a ish woody column, separated by a narrow dark undulated cambial Neither the wood nor the cortical tissue present a radiate structure stout pieces; in the thinner roots, medullary rays are obvious in ody part. The extremely thin corky layer easily separates from rk, which latter is frequently marked transversely by large cracks. ost whether fresh or dried, has an agreeable odour resembling lean or melilot. The dried root has a sweetish taste with very acridity. The stems are almost tasteless and inodorous. The ound in the English market is often of very bad quality.

[1] *Archiv der Pharmacie*, 1861.

[2] It has been recently extravagantly in Madras as a substitute for quinine.

[3] It is an Indian root figured as *Pala* by Acosta (*Tractado de las Drogas* *Indias Orientales*, 1578, cap. lv.) is astonishingly like the drug in . He describes it moreover, as having a sweet smell of melilot. The plant he says is called in Canarese *Dabi* The figure is reproduced in Antoine Colin's translation, but not in that of Clusius.

[4] *Lond. Med. and Phys. Journ.* lxv. 1829.

[5] Taken from excellent specimens obligingly sent to us from India by Dr. I. W Stewart and Mr. Broughton.

Microscopic Structure—All the proper cortical tissue sh uniform parenchyme, not distinctly separated into liber, medullary and mesophlœum. On making a longitudinal section however, on observe some elongated laticiferous vessels filled with the colourles crete milky juice. In a transverse section, they are seen to be irreg scattered through the bark, chiefly in its inner layers, yet even h not very considerable number. They are frequently 30 mkm. in dia and not branched.

The wood is traversed by small medullary rays, which are ob only in the longitudinal section. The parenchymatous tissue of th is loaded with large, ovoid starch granules. Tannic matters do not to any considerable amount, except in the outermost suberous laye

Chemical Composition—The root has not been submitted t adequate chemical examination. Its taste and smell appear t depend on the presence of essential oil, so far as may be inferred microscopic examination; and it is probable the aroma is due to a of the cumarin class. According to Scott,[1] the root yields by s distillation with water, a stearoptene, which is probably the sub obtained by Garden in 1837, and supposed to be a volatile acid.

Uses—The drug is reputed to be alterative, tonic, diureti diaphoretic, but is rarely employed, at least in England.

CORTEX MUDAR.

Cortex Calotropidis; Mudar; F. *Ecorce de racine de Mudar*

Botanical Origin—The drug under notice is furnished by two allied species of *Calotropis*, occupying somewhat distinct geogra areas, but not distinguished from each other in the native langua India. These plants are:—

1. *Calotropis procera* R. Brown (*C. Hamiltonii* Wight), a large 6 or more feet high, with dark green, oval, opposite leaves, downy be abounding in an acrid milky juice.

It is a native of the drier parts of India, as the Deccan, the Provinces of Bengal, the Punjab and Sind, but is quite unknown southern provinces; it also extends to Persia, Palestine, the S Peninsula, Arabia, Egypt, Nubia, Abyssinia, the oases of the Sahar Sudan. Lastly it has been naturalized in the West Indies.

2. *C. gigantea* R. Brown (*Asclepias gigantea* Willd.), a large shrub, 6 to 10 feet high, with stem as thick as a man's leg,[2] resembling the preceding, indigenous to Lower Bengal and the so parts of India, Ceylon, the Malayan Peninsula, and the Moluccas.

Both species are extremely common in waste ground over respective areas.[3]

History—Mudar is frequently mentioned in the writings of S

[1] *Pharm. of India*, 157; also *Chem. Gazett.*, 1843, 378.

[2] Hence the specific name *gigantea*.

[3] The botanical distinctions between the two species may be stated thus:—

C. procera, corolla cup-shaped, petals somewhat erect, flowerbuds spherical dages of corona with a blunt upwar

C. gigantea, corolla opening flat, buds bluntly conical or oblong, app of corona rounded.

st therefore have been in use in India prior to the Christian era; 'as well known to the Arabian physicians.[1]

***procera* was observed in Egypt by Prosper Alpinus (1580–84), n his return to Italy was figured, and some account given of its al properties.[2]**

***igantea* was figured by Rheede[3] in 1679, and in our own day by**

medicinal virtues of mudar, though so long esteemed by the of India, were not investigated experimentally by Europeans until ent century, when Playfair recommended the drug in elephantiasis, good effects were afterwards noticed by Vos (1826), Cumin (1827), ican (1829). The last-named physician also performed a chemical ation of the root-bark, the activity of which he referred to an re matter which he termed *Mudarine*.[5]

cription—The root-bark of *C. procera*, as we have received it,[6] of short, arched, bent, or nearly flat fragments, ⅛ to ⅓ of an inch They have outwardly a thickish, yellowish-grey, spongy cork, less fissured lengthwise, frequently separating from the middle layer; the latter consists of a white mealy tissue, traversed by brown liber-rays. The bark is brittle and easily powdered; it mucilaginous, bitter, acrid taste, but no distinctive odour. The llow, fibrous wood is still attached to many of the pieces.

roots of *C. gigantea* are clothed with a bark which seems to stinguishable from that of *C. procera* just described. The wood root consists of a porous, pale-yellow tissue, exhibiting large bundles, and very numerous small medullary rays, consisting of ows of the usual cells.[7]

roscopic Structure—In the root-bark of *C. procera*, the suberous made up of large, thin-walled, polyhedral, or almost cubic cells; dle cortical layer, of a uniform parenchyme, loaded with large granules, or here and there containing some thick-walled cells chyme) and tufts of oxalate of calcium. The large medullary built up of the usual cells, having porous walls and containing nd oxalate. In a longitudinal section, the tissue chiefly of the cortical layer, is found to be traversed by numerous laticiferous containing the dry milk juice[8] as a brownish granular substance ble in potash.

microscopic characters of the root-bark of *C. gigantea* agree with re detailed of *C. procera*. The stems of *Calotropis* are distin- by strong liber fibres, which are not met with in the roots.

mical Composition—By following the process of Duncan above

arthar, translated by Sontheimer, 193.

antis Ægypti, Venet. 1592. cap.

Malabaricus, ii. tab. 31.

ations of Indian Botany, Madras, tab. 155.—*C. procera* is figured by author in his *Icones Plantarum ntalis*, iv. tab. 1278.

Med. and Surg. Journ. xxxii.

e indebted for an authentic speci- . E. Burton Brown of Lahore.

[7] Roots of *C. gigantea* kindly supplied to us by Dr. Bidie of Madras consist of light, woody truncheons, ½ to 2½ inches in diameter.

[8] It is evidently with a view to the retention of this juice, that the *Pharmacopœia of India* orders the bark to be stripped from the roots when the latter are half-dried. Moodeen Sheriff remarks of *C. gigantea*, that although it is frequently used in medicine, no part of it is sold in the bazaars,—no doubt from the circumstance that the plant is everywhere found wild and can be collected as required.

alluded to, 200 grammes of the powdered bark of *C. gigantea* yield nothing like his *Mudarine*, but 2·4 grammes of an acrid *resin*, sol in ether as well as in alcohol. The latter solution reddens litmus; former on evaporation yields the resin as an almost colourless mass the aqueous liquid is separated from the crude resin, and much abs alcohol added, an abundant precipitate of mucilage is obtained. liquid now contains a bitter principle, which after due concentration be separated by means of tannic acid.

We obtained similar results by exhausting the bark of *C. procera* dilute alcohol. The tannic compound of the bitter principle was n with carbonate of lead, dried and boiled with spirit of wine. after evaporation furnished an amorphous, very bitter mass, not so in water, but readily so in absolute alcohol. The solution is *not* pitated by an alcoholic solution of acetate of lead. By purifyin bitter principle with chloroform or ether, it is at last obtained colou This bitter matter is probably the active principle of *Calotropis* ascertained by means of the usual tests, that no alkaloid occurs i drug. The large juicy stem, especially that of *C. gigantea*, ought submitted to an accurate chemical and therapeutical examination.[1]

Uses—Mudar is an alterative tonic, and diaphoretic,—in large emetic. By the natives of India who employ it in venereal and complaints, almost all parts of the plant are used. According to Mo Sheriff,[2] the bark of the root and the dried milky juice are the efficient; the latter is however somewhat irregular and unsafe action. The same writer remarks that he has found that the old plant, the more active is the bark in its effects. He recommend the corky outer coat which is tasteless and inert, should be scrap before the bark is powdered for use: of a powder so prepared, 40 grains suffice as an emetic.

The stems of *C. gigantea* afford a very valuable fibre which c spun into the finest thread for sewing or weaving.[3]

FOLIA TYLOPHORÆ.

Country or Indian Ipecacuanha.

Botanical Origin—*Tylophora asthmatica* Wight et Arnott (*As asthmatica* Roxb.), a twining perennial plant, common in sandy throughout the Indian Peninsula and naturalized in Mauritius. I be distinguished from some of its congeners by its reddish or dul flowers, with the scale of the staminal corona abruptly contracted long sharp tooth.

History—The employment of this plant in medicine is well k to the Hindus, who call it *Antamúl* and use it with considerable s in dysentery. During the last century, it attracted the atten Roxburgh[4] who made many observations on the administration

[1] List's *Asclepione* (Gmelin's *Chemistry*, xvii. 368) might then be sought for.

[2] *Supplement to the Pharmacopœia of India*, Madras, 1869. 364; for further information on the therapeutic uses of mu ar. *Pharm. of India*, 458.

[3] Drury, *Useful Plants of Ind*, 1873. 101.

[4] *Flora Indica*, ed. Carey, ii. (183

ile physician to the General Hospital of Madras from 1776 to It was also used very successfully in the place of ipecacuanha erson, Physician-General to the Madras army.[1] In more recent ıe plant has been prescribed by O'Shaughnessy, who pronounced an excellent substitute for ipecacuanha if given in rather larger Kirkpatrick[3] administered the drug in at least a thousand cases, ıd it of the greatest value; he prescribed the *dried leaf*, not only superior to the root in certainty of action, but also as being ıle without destruction of the plant. The drug has been largely y many other practitioners in India. *Tylophora* is also em- ın Mauritius, where it is known as *Ipéca sauvage* or *Ipéca du* t has a place in the *Bengal Pharmacopœia* of 1844, and in the *copœia of India* of 1868.

cription[4]—The leaves are opposite, entire, from 2 to 5 inches long, inches broad, somewhat variable in outline, ovate or subrotund, cordate at the base, abruptly acuminate or almost mucronate, rather , glabrous above, more or less downy beneath with soft simple The pedicel which is channelled, is ½ to ¾ of an inch in length. ry state the leaves are rather thick and harsh, of a pale yellow- ı; they have a not unpleasant herbaceous smell, with but very te.[5]

mical Composition—A concentrated infusion of the leaves has y acrid taste. It is abundantly precipitated by tannic acid, by acetate of lead or caustic potash, and is turned greenish-black loride of iron. Broughton of Ootacamund (India) has informed ?) that from a large quantity of the leaves he obtained a small of crystals,—insufficient for analysis. Dissolved and injected nall dog, they occasioned purging and vomiting.

s—Employed in India, as already mentioned, as a substitute for nha, chiefly in the treatment of dysentery. The dose of the l leaves as an *emetic* is 25 to 30 grains, as a diaphoretic and ant 3 to 5 grains.

ix Tylophoræ—This root is met with in the Indian bazaars, and employed as before stated, as much or more than the leaf. It of a short, knotty, descending rootstock, about ½ of an inch in s, emitting 2 to 3 aerial stems, and a considerable number of ts. These roots are often 6 inches or more in length by ½ a line ter and are very brittle. The whole drug is of a pale yellowish it has no considerable odour, but a sweetish and subsequently ste. In general appearance it is suggestive of valerian, but is ıt stouter and larger.

nined microscopically, the parenchymatous envelope of the is seen to consist of two layers, the inner forming a small

ıg, *Catalogue of Indian Plants*, Calcutta, 1810. 8.

Inspectory (1842) 455.

ne of Madras Exhibition of 1855, Mysore drugs; also *Pharm. of*

up from an ample specimen kindly presented to us together with one of the root, by Mr. Moodeen Sheriff of Madras.

[3] A figure of the leaves may be found in a paper on *Urticaceæ* by M. C. Cooke, *Pharm. Journ.* Aug. 6, 1870, 105; and one of the whole plant in Wight's *Icones Plantarum Indiæ Orientalis*, iv. (1850) tab. 1277.

nucleus sheath. The outer portion is built up of large cells, loade starch granules and tufted crystals of oxalate of calcium. Salts (do not alter the tissue.

LOGANIACEÆ.

NUX VOMICA.

Semen Nucis Vomicæ; Nux Vomica; F. *Noix vomique;* G. *Bred*

Botanical Origin—*Strychnos Nux-vomica* L., a moderate siz with short, thick, often crooked stem, and small, greenish-white, flowers ranged in terminal corymbs. It is indigenous to most p India, especially the coast districts, and is found in Burmah Cochin China and Northern Australia.

The ovary of *S. Nux-vomica* is bi-locular, but as it adva growth, the dissepiment becomes fleshy and disappears. The frui is an indehiscent berry of the size and shape of a small or filled with a bitter, gelatinous white pulp, in which the seeds, 1 number, are placed vertically in an irregular manner. The epica a thin, smooth, somewhat hard shell, which at first is greenish, b mature, of a rich orange-yellow. The pulp of the fruit contains str yet it is said to be eaten in India by birds.[2] The wood, which and durable, is very bitter.

History—Nux Vomica, which was unknown to the anc thought to have been introduced into medicine by the Arabiar the notices in their writings which have been supposed to refer t far from clear and satisfactory. We have no evidence moreove was used in India at an early period. Garcia d' Orta, an thoroughly acquainted with the drugs of the west coast of Indi middle of the 16th century, is entirely silent as to nux Fleming[3] writing at the beginning of the present century, rema nux vomica is seldom, if ever, employed in medicine by the but this statement does not hold good now.

The drug was however certainly made known in Germany in t century. Valerius Cordus[4] wrote a description of it about t 1540, which is remarkable for its accuracy. Fuchs, Bauhin an

[1] Roxburgh's assertion that the pulp "*seems perfectly innocent*," induced us to examine it chemically, which we were enabled to do through the kindness of Dr. Thwaites, of the Royal Botanical Gardens, Ceylon. The *inspissated pulp* received from Dr. T., diluted with water, formed a very consistent jelly having a slightly acid reaction and very bitter taste. Some of it was mixed with slaked lime, dried, and then exhausted by boiling chloroform. The liquid left on evaporation, a yellowish resinoid mass, which was warmed with acetic acid. The colourless solution yielded a perfectly white, crystalline residue, which was dissolved in water, and precipitated with bichromate of potassium. The precipitate dried, and moistened with strong sulphuric acid, exhibited the violet hue ch of strychnine.

To confirm this experiment, w through the obliging assistance of of Madras, some of the white p with a spoon from the interior fruit, and at once immersed *per s* of wine. The alcoholic fluid gave evidence of the presence of strych.

[2] According to Cleghorn by th (*Buceros malabaricus*); according burgh by "many sorts of bird." (*Flora Sylvatica*, Madras, 1872. the pulp is quite harmless, and th food of many birds.

[3] *Catalogue of Indian Med. I Drugs*, Calcutta, 1810. 37.

[4] *Hist. Stirpium*, edited by Argentorat. 1561. lib. iv. c. 21.

ticed it as *Nux Metella*, a name taken from the *Methel* of Avicenna and ner Arabian authors.[1]

It was found in the English shops in the time of Parkinson (1640), ıo remarks that its chief use is for poisoning dogs, cats, crows and rens, and that it is rarely given as a medicine.

Description—Nux Vomica is the *seed*, removed from the pulp d shell. It is disc-like, or rather irregularly orbicular, a little less an an inch in diameter, by about a quarter of an inch in thickness, ightly concave on the dorsal, convex on the ventral surface, or nearly it on either side, often furnished with a broad, thickened margin so that e central portion of the seed appears depressed. The outside edge is unded or tapers into a keel-like ridge. Each seed has on its edge a nall protuberance, from which is a faintly projecting line (raphe) nning to a central scar which is the hilum or umbilicus; a slight ipression marks the opposite side of the seed. The seeds are of a light eyish hue, occasionally greenish, and have a satiny or glistening aspect, y reason of their being thickly covered with adpressed, radiating irs. Nux vomica is extremely compact and horny, and has a very itter taste.

After having been softened by digestion in water, the seed is easily it along its outer edge, then displaying a mass of translucent, cartilaıous albumen, divided into two parts by a fissure in which lies the nbryo. This latter is about $\frac{3}{16}$ of an inch long, having a pair of delicate, - to 7- nerved, heart-shaped cotyledons, with a club-shaped radicle, the nition of which is indicated on the exterior of the seed by the small otuberance already named.

Microscopic Structure—The hairs of nux vomica are of remarkle structure. They are formed as usual of the elongated cells of the idermis, and have their walls thickened by secondary deposits, which e interrupted by longitudinally extended pores; they are a striking ject in polarized light. The albumen is made up of large cells, loaded ith albuminoid matters and oily drops, but devoid of starch. In water, e thick walls of this parenchyme swell up and yield some mucilage; e cotyledons are built up of a narrow, much more delicate tissue, aversed by small fibro-vascular bundles.

The alkaloids are not directly recognizable by the microscope; but if ry thin slices of nux vomica are kept for some length of time in ycerin, they develope feathery crystals, doubtless consisting of these ses.

Chemical Composition—The bitter taste and highly poisonous tion of nux vomica, are chiefly due to the presence of *Strychnine* and *ucine*. Strychnine, $C^{21}H^{22}N^2O^2$, was first met with in 1818 by Pelletier d Caventou in St. Ignatius' Beans, and immediately afterwards in nux mica. It crystallizes from an alcoholic solution in large anhydrous ıms of the orthorhombic system. It requires for solution about 6700 rts of cold or 2500 of boiling water; the solution is of decidedly aline reaction, and an intensely bitter taste which may be distinctly ceived though it contain no more than $\frac{1}{800000}$ of the alkaloid. e best solvents for strychnine are spirit of wine or chloroform; it

[1] Clusius and others held the opinion that *Nux methel* of the Arabs was the fruit of a *Datura*, and an Indian species was accordingly named by Linnæus, *D. Metel*.

is but very sparingly soluble in absolute alcohol, benzol, amylic alc or ether. The alcoholic solution deviates the ray of polarized lig the left.

Strychnine is not restricted to the fruit of the plant under m but also occurs in the wood.[1] It is moreover found in the wood o root of *Strychnos colubrina* L., and in the bark of the root of *Stry Tieute* Lesch., both species indigenous to the Indian Archipelago.

The discovery of *Brucine* was made in 1819 by the same che in nux vomica bark, then supposed to be derived from *Brucea ferru* Its presence in nux vomica and St. Ignatius' Bean, was pointed o them in 1824. Brucine, dried over sulphuric acid, has the fo $C^{23}H^{26}N^2O^4$, but it crystallizes from its alcoholic solution with 4 It readily neutralizes acids, forming crystalline salts. In bitterne poisonous properties, as well as in rotatory power, it closely rese strychnine, differing however in the following particulars:—it is s in about 150 parts of boiling water, melts without alteration a above 100° C. In common with its salts, it acquires a dark red when moistened with concentrated nitric acid. By heating b with hydrochloric or sulphuric acid in sealed tubes, it is entirely d posed, and then, according to Baudrimont (1869), yields among products sugar.

The proportion of strychnine in nux vomica appears to var $\frac{1}{4}$ to $\frac{1}{2}$ per cent. That of brucine is variously stated to be 0·12 (M 0·5 (Wittstein), 1·01 (Mayer) per cent.

A third crystallizable base, called *Igasurine*, was discovered in by Desnoix, in the liquors from which strychnine and brucine ha precipitated by lime. Schützenberger has stated (1858) that th stance thus obtained consists of as many as nine distinct bases, no belonging to one and the same homologous series, which he has guished by letters (*a*-Igasurine, *b*-Igasurine, &c.) They differ fro other in composition, in solubility, and in the proportion of water they lose when heated to 130° C. Igasurine has the bitter tast poisonous properties of the other strychnos alkaloids.[2]

According to Schützberger, even strychnine itself is not a d substance, but is a mixture of three different bases. All these ments respecting igasurine and strychnine require in our opinio confirmed by further researches.

In nux vomica, as well as in St. Ignatius' Beans, the alk according to their discoverers, are combined with *Strychnic* or *I Acid*; Ludwig (1873) who prepared this body from the latter describes it as a yellowish-brown amorphous mass, having a st acid reaction and a sour astringent taste; and striking a dark gre ferric salts.

Nux vomica dried at 100° C. yielded us when burnt with sod 1·822 per cent. of nitrogen, indicating about 11·3 per cent. of substances. By boiling ether, we removed from the seeds 4 cent. of fat; they also contain mucilage and sugar. The latter,

[1] It is remarkable that parasitic plants of the order *Loranthaceæ* growing on *Strychnos Nux-vomica*, acquire the poisonous properties of the latter.—*Pharm. of India*, 1868. 108.

[2] For further information on i consult Gmelin, *Chemistry*, xvi 589; Watts, *Dictionary of Chem* (1865) 243; *Pharm. Journ.* xvi 432.

to Rebling (1853) exists to the extent of 6 per cent., re-
ric oxide without the aid of heat. When macerated in water,
easily undergo lactic fermentation, not however attended with
tion of the alkaloids. The stability of strychnine is remark-
after ten years of contact with putrescent animal substances.

nerce—Large quantities of nux vomica are brought into the
arket from British India.[1] The export from Bombay in the
–72 was 3341 cwt., all shipped to the United Kingdom.[2]
1869–70 exported 4805 cwt.; and Calcutta in 1865–66, 2801
quantity imported into the United Kingdom in 1870[3] was

—Tincture and extract of nux vomica, and the alkaloid strych-
frequently administered as tonic remedies in a variety of

SEMEN IGNATII.

ti Ignatii; St. Ignatius' Beans; F. *Fèves de Saint-Ignace, Noix Igasur;* G. *Ignatiusbohnen.*[4]

ical Origin — *Strychnos Ignatii* Bergius[5] (*S. Philippensis natiana Philippinica* Loureiro), a large climbing shrub, growing Samar, and Çebu, islands of the Bisaya group of the Philippines, ling to Loureiro in Cochin China, where it has been introduced. rescence and foliage are known to botanists only from the as given by Loureiro[6] and Blanco.[7] The fruit is spherical, or ovoid, 4 inches or more in diameter, and consists of a smooth ell enclosing seeds to the number of about 24. G. Bennett,[8] he fruits at Manila sold in the bazaar, says they contain from eds, imbedded in a glutinous blackish pulp.[9]

ry—It is stated by Murray[10] and later writers, that this seed luced into Europe from the Philippines by the Jesuits, who, on its virtues, bestowed upon it the name of Ignatius, the founder rder. However this may be, the earliest account of the drug be that communicated by Camelli, Jesuit missionary at

seen 1136 packages offered in a ale (30 March, 1871).

t of the Trade and Navigation ir 1871-72, pt. ii. 62.

returns are accessible.

it and seeds are known in the age by the names of *pangasion, canlara, manananay, dangga* or *igasur;* in the islands of Çebu, where the seeds are pro- hat of *coyacoy*, and by the the Philippines as *Pepita de vita de Catbalogan* (Clain, *Reme-* Manila, 1857. p. 610). The *atius' Bean* applied to them in nployed in South America to e seeds of several medicinal , as those of *Feuillea trilobata ra Guapeva* Manso and *Aniso- iflora* Manso.

[5] *Materia Medica*, Stockholm, 1778. i. 146.—We omit citing the Linnean *Ignatia amara*, as it has been shown by Bentham that the plant so named by the younger Linnæus is *Posoqueria longiflora* Aubl. of the order *Rubiaceæ*, a native of Guiana.

[6] *Flora Cochinchinensis*, ed. Willd. i. (1793) 155.

[7] *Flora de Filipinas*, ed. 2. 1845. 61.

[8] *London Med. and Phys. Journ.*, January 1832.

[9] The only specimen of the fruit I have seen was in the possession of my late friend Mr. Morson. It measured exactly 4 inches in diameter, and when opened (15 January 1872) was found to contain 17 mature, well-formed seeds, with remnants of dried pulp. As figured on the authority of Camelli, the fruit is *ovoid*, 6¾ inches long by 4¼ in diameter.—D. H.

[10] *Apparatus Medicaminum*, vi. (1792) 26.

Manila, to Ray and Petiver, and by them laid before the Royal S of London in 1699.[1] Camelli proclaimed the seed to be the *Nux V legitima* of the Arabian physician Serapion, who flourished in th century, but in our opinion there is no warrant whatever for supp it to have been known at so remote a period.[2] Camelli states th seed, which he calls *Nux Pepita seu Faba Sancti Ignatii*, is esteemed as a remedy in various disorders, though he was well of its poisonous properties when too freely administered. In Ger St. Ignatius' Bean was made known about the same period by Bo Leipzig.[3]

The drug is found in the Indian bazaars under a name whi evidently corrupted from the Spanish *pepita*. It is met with i drugshops of China as *Leu-sung-kwo*, i.e. *Luzon fruit*.

Description—St. Ignatius' Beans are about an inch in length; form is ovoid, yet by mutual pressure it is rendered very irregula they are 3-, 4-, or 5-sided, bluntly angular, or flattish, with a conspi hilum at one end. In the fresh state, they are covered with s adpressed hairs: portions of a shaggy brown epidermis are her there perceptible on those found in commerce, but in the majorit seed shows the dull grey, granular surface of the albumen itself.

Notwithstanding the different outward appearance, the struct St. Ignatius' Beans accords with that of nux vomica. The radicle ever is longer, thicker, and frequently somewhat bent, and the coty are more pointed. The horny brownish albumen is translucent, ver and difficult to split. The whole seed swells considerably by pro digestion in warm water, and has then a heavy, earthy smell. The are intensely bitter and highly poisonous.

Microscopic Structure—The hairs of the epidermis are analogous structure but more simple than in nux vomica. The al and cotyledons agree in structural features with those of the sam in nux vomica.

Chemical Composition—Strychnine exists to the extent of 1·5 per cent.; the seed also contains 0·5 per cent. of brucine. over sulphuric acid and burnt with soda-lime, it yielded us an a of 1·78 per cent. of nitrogen, which would answer to about 10 pe of albuminoid matter.

Commerce—We have no information as to the collection drug. The seeds are met with irregularly in English trade, being times very abundant, at others scarcely obtainable.

Uses—The same as those of nux vomica. When procurab moderate price, the seeds are valued for the manufacture of stry

[1] *Phil. Trans.* xxi. (1699) 44. 87; Ray, *Hist. Plant.* iii. lib. 31. 118.

[2] The Philippines were wholly unknown to the Europeans of antiquity or of the Middle Ages. They were discovered by Magellan in 1521, but their conquest by the Spaniards was not effectually commenced until 1565. Previous to the Spa pation, they were governed by p and were frequented for the purp merce by Japanese, Chinese, and M

[3] Martigny, *Encyklopädie d. R* i. (1843) 576.

RADIX SPIGELIÆ.

Radix Spigeliæ Marilandicæ; Indian Pink Root, Carolina Pink Root, Spigelia.[1]

Botanical Origin—*Spigelia Marilandica* L., an herbaceous plant about a foot high, indigenous in the woods of North America, from Pennsylvania to Wisconsin and southward. According to Wood and Bache, it is collected chiefly in the Western and South-western States.

History—The anthelmintic properties of the root, discovered by the Indians, were brought to notice in Europe about the year 1754, by Linning, Garden, and Chalmers, physicians of Charleston, South Carolina. The drug was admitted to the London Pharmacopœia in 1788.

Description—Pink root has a near resemblance to serpentary, consisting of a short, knotty, dark brown rhizome emitting slender wiry roots. It is quite wanting in the peculiar odour of the latter drug, or indeed in any aroma; in taste it is slightly bitter and acrid. Sometimes the entire plant with its quadrangular stems a foot high is imported. It has opposite leaves about 3 inches long, sessile, ovate-lanceolate, acuminate, smooth or pubescent.

Microscopic Structure—The transverse section of the rhizome, about $\frac{2}{16}$ of an inch in diameter, shows a small woody zone enclosing a large pith of elliptic outline, consisting of thin-walled cells. Usually the central tissue is decayed. In the roots, the middle cortical layer predominates; it swells in water, after which its large cells display fine spiral markings. The nucleus-sheath observable in serpentary, is wanting in spigelia.

Chemical Composition—Not satisfactorily known: the vessels of the wood contain resin, the parenchyme starch; in the cortical part of the rhizome, some tannic matters occur, but not in the roots. Feneulle (1823) asserts that the drug yields a little essential oil. The experiments of Bureau[2] show that spigelia acts on rabbits and other animals as a narcotico-acrid poison.

Uses—Spigelia has long been reputed a most efficient medicine for the expulsion of *Ascaris lumbricoides*, but according to Stillé,[3] its real value for this purpose has probably been over-estimated. This author speaks of it as possessing alterative and tonic properties. In England, it is rarely prescribed by the regular practitioner, but is used as a household medicine in some districts. It is much employed in the United States.

GENTIANEÆ.

RADIX GENTIANÆ.

Gentian Root; F. *Racine de Gentiane;* G. *Enzianwurzel.*

Botanical Origin—*Gentiana lutea* L., a handsome perennial herb, growing 3 feet high, indigenous to open grassy places on the mountains

[1] *Pink Root* is sometimes erroneously labelled in price-lists, "*Radix caryophylli.*"
[2] *De la famille des Loganiacées*, 1856. 130.
[3] *Therapeutics and Materia Medica*, Philadelphia, ii. (1868) 651.

of Middle and Southern Europe. It occurs in Portugal, Spain, the Pyrenees, in the islands of Sardinia and Corsica, in the Apennines, the mountains of Auvergne, the Jura, the Vosges, the Black Forest, and throughout the chain of the Alps as far as Bosnia and the Danubian Principalities. Among the mountains of Germany, it is found on the Suabian Alps near Würzburg, and here and there in Thuringia, but not further north, nor does it occur in the British Islands.

History—The name *Gentiana* is said to be derived from Gentius, a king of the Illyrians, living B.C. 180–167, by whom according to both Pliny and Dioscorides, the plant was noticed. Whether the species thus named was *Gentiana lutea* is doubtful. During the middle ages, gentian was commonly employed for the cure of disease, and as an antidote to poison. Tragus in 1552, mentions it as a means of dilating wounds, an application which has been resorted to in modern medical practice.

Description—The plant has a cylindrical, fleshy, simple root, of pale colour, occasionally almost as much as 4 feet in length by 1½ inches in thickness, producing 1 to 4 aerial stems.

The dried root of commerce is in irregular, contorted pieces, several inches in length, and ½ to 1 inch in thickness; the pieces are much wrinkled longitudinally, and marked transversely, especially in their upper portion, with numerous rings. Very often they are split to facilitate drying. They are of a yellowish brown; internally of a more orange tint, spongy, with a peculiar, disagreeable, heavy odour, and intensely bitter taste. The crown of the root, which is somewhat thickened, is clothed with the scaly bases of leaves. The root is tough and flexible,—brittle only immediately after drying. We found it to lose in weight about 18 per cent. by complete drying in a water-bath: it regained 16 per cent. by being afterwards exposed to the air.

Microscopic Structure—A transverse section shows the bark separated by a dark cambial zone from the central column; the radial arrangement of the tissues is only obvious in the latter part. In the bark, liber fibres are wanting; and in the centre there is no distinct pith. The fibro-vascular bundles are devoid of thick-walled ligneous prosenchyme; this may explain the consistence, and the short even fracture of the root. It is moreover remarkable on account of the absence both of starch and oxalate of calcium; the cells appear to contain chiefly sugar and a little fat oil.

Chemical Composition—The bitter taste of gentian is due to a substance called *Gentiopicrin* or *Gentian-bitter*.[1] Several chemists, as Henry, Caventou, Trommsdorff, Leconte, and Dulk have described the bitter principle of gentian in an impure state, under the name of *Gentianin*, but Kromayer in 1862 first obtained it in a state of purity.

Gentiopicrin, $C^{20}H^{30}O^{12}$, is a neutral body crystallizing in colourless needles, which readily dissolve in water. It is soluble in spirit of wine but in absolute alcohol only when aided by heat; it does not dissolve in ether. A solution of caustic potash or soda forms with it a yellow solution. Under the influence of a dilute mineral acid, gentiopicrin is resolved into glucose, and an amorphous, yellowish-brown, neutral sub-

[1] Gmelin, *Chemistry*, xvi. (1864) 193.

tance, named *Gentiogenin.* Fresh gentian roots yield somewhat more han $\frac{1}{16}$ per cent. of gentiopicrin; from the dried root it could not be btained in a crystallized state. The medicinal Tincture of Gentian, ixed with solution of caustic potash, loses its bitterness in a few days, robably in consequence of the destruction of the gentiopicrin.

Another constituent of gentian root is *Gentianic Acid*, $C^{14}H^{10}O^5$, a asteless substance, forming pale yellow, silky crystals, which may be ublimed if cautiously heated. It is but very slightly soluble in water, whether cold or hot, or in ether, but dissolves in hot strong alcohol, from which it may be crystallized. It also dissolves in aqueous alkalis, orming crystallizable compounds. Gentianic acid appears to be without ction on the organism.

Gentian root abounds in pectin; it also contains to the extent of 12 o 15 per cent., an uncrystallizable sugar, of which advantage is taken n Southern Bavaria and Switzerland, for the manufacture by fermentaion and distillation of a potable spirit.[1] This use of gentian and its onsumption in medicine, have led to the plant being almost extirpated n some parts of Switzerland where it formerly abounded.

Commerce—Gentian root finds its way into English commerce hrough the German houses; and some is shipped from Marseilles. The uantity imported into the United Kingdom in 1870, was 1100 cwt.

Uses—Gentian is much used in medicine as a bitter tonic. Ground n powder, the root is an ingredient in some of the compositions sold for ating cattle.

Substitutes—It can hardly be said that gentian is adulterated, yet he roots of several other species possessing similar properties are occaionally collected; of these we may name the following:—

1. *Gentiana purpurea* L.—This species is found in Alpine meadows f the Apennines, Savoy and Switzerland, in Transylvania, and in outhern Norway; a variety also in Kamtchatka.[2] The root is frequently lected; it attains at most 18 inches in length and a diameter of out 1 inch at the summit, from which arise 8 to 10 aerial stems, ished below with many scaly remains of leaves. The top of the t has thus a peculiar branched appearance, never found in the root *G. lutea*, with which in all other respects that of *G. purpurea* agrees. he latter is perhaps even more intensely bitter.

2. *G. punctata* L.—Nearly the same description applies to this pecies, which is a native of the Southern Alps, extending eastward to ustria, Hungary and Roumelia.

3. *G. Pannonica* Scop.—a plant of the mountains of Austria, unown in the Swiss Alps, has a root which according to Vogl,[3] does not ain the length or the thickness of the root of *G. purpurea*, with ich it agrees in other respects. It is officinal in the Austrian rmacopœia.

[1] Th. Martius, *Pharm. Journ.* xii. (1853) 1.

[2] Grisebach (*Die Vegetation der Erde*, i. 223) gives very interesting particulars ating to the area of growth of *Gentiana purpurea*, *G. punctata* and *G. Pannonica*. He is decidedly of the opinion that they are distinct species.

[3] *Commentar zur österreichischen Pharmakopöe*, i. (1869) 345.

HERBA CHIRATÆ.

Herba Chirettæ vel Chirayta; Chiretta or Chirayta.

Botanical Origin—*Ophelia*[1] *Chirata* Grisebach (*Gentiana Chiraya* Roxb.) an annual herb of the mountainous regions of Northern India from Simla through Kumaon to the Murung district in South-eastern Nepal.

History—Chiretta has long been held in high esteem by the Hindus, and is frequently mentioned in the writings of Susruta. It is called in Sanscrit *Kirâta-tikta*, which means the *bitter plant of the Kirâtas*, the Kirâtas being an outcast race of mountaineers in the north of India. In England, it began to attract some attention about the year 1829; and in 1839 was introduced into the Edinburgh Pharmacopœia. The plant was first described by Roxburgh in 1814.

Chiretta was regarded by Guibourt as the *Calamus aromaticus* of the ancients, but the improbability of this being correct was well pointed out by Fée[2] and by Royle, and is now generally admitted.

Description—The entire plant is collected when in flower, or most commonly when the capsules are fully formed, and tied up with a slip of bamboo into flattish bundles of about 3 feet long,[3] each weighing when dry from $1\frac{1}{2}$ to 2 ℔. The stem, $\frac{2}{10}$ to $\frac{3}{10}$ of an inch in thickness, is of an orange-brown, sometimes of a dark purplish colour; the tapering simple root, often much exceeding the stem in thickness, is 2 to 4 inches long and up to $\frac{1}{2}$ an inch thick. It is less frequently branched, but always provided with some rootlets. In stronger specimens, the root is somewhat oblique or geniculate; perhaps the stem is in this case the product of a second year's growth and the plant not strictly annual. Each plant usually consists of a single stem, yet occasionally two or more springs from a single root. The stem rises to a height of 2 to 3 feet, and is *cylindrical in its lower and middle portion*, but bluntly quadrangular in its upper, the four edges being each marked with a prominent decurrent line, as in *Erythræa Centaurium* and many other plants of the order. The decussate ramification resembles that of other gentians; its stem are jointed at intervals of $1\frac{1}{2}$ to 3 or 4 inches, bearing opposite sessile amplexicaul leaves or their cicatrices. The stem consists in its lower portion of a large woody column, coated with a very thin rind, and enclosing a comparatively large pith. The upper parts of the stem and branches contain a broad ring of thick-walled woody parenchyme. The numerous slender axillary and opposite branches are elongated, and they constitute a dense umbellate panicle. They are smooth and glabrous, of a greenish or brownish grey colour.

The leaves are ovate-acuminate, cordate at the base, entire, sessile, the largest 1 inch or more in length, 3- to 5- or 7-nerved, the midrib being strongest. At each division of the panicle there are two small bracts. The yellow corolla is rotate, 4-lobed, with glandular pits above the base; the calyx is one-third the length of the petals, which are about half an inch long. The one-celled, bivalved capsule contains numerous seeds.

[1] Ὀφέλλειν, to bless, in allusion to the medical virtues of the herb.

[2] *Cours d'Histoire nat. pharmaceutique*, ii. (1828) 395.

[3] The other kinds of chiretta to be met with presently are usually much shorter.

The flowers share the intense bitterness of the whole drug. The ood of stronger stems is devoid of the bitter principles.

Chemical Composition—A chemical examination of chiretta has een made at our request under the direction of Professor Ludwig of ena, by his assistant Mr. Höhn. The chief results of this careful and laborate investigation may be thus described.[1]

Among the bitter principles of the drug, *Ophelic Acid*, $C^{13}H^{20}O^{10}$, ccurs in the largest proportion. It is an amorphous, viscid, yellow ubstance, of an acidulous, persistently bitter taste, and a faint gentian-ke odour. With basic acetate of lead, it produces an abundant yellow recipitate. Ophelic acid does not form an insoluble compound with annin; it dissolves in water, alcohol and ether. The first solution auses the separation of protoxide of copper from an alkaline tartrate f that metal.

A second bitter principle, *Chiratin*, $C^{26}H^{48}O^{15}$, may be removed by eans of tannic acid, with which it forms an insoluble compound. hiratin is a neutral, not distinctly crystalline, light yellow, hygroscopic owder, soluble in alcohol, ether and in warm water. By boiling hydro-hloric acid, it is decomposed into *Chiratogenin*, $C^{13}H^{24}O^{4}$, and ophelic cid. Chiratogenin is a brownish, amorphous substance, soluble in lcohol but not in water, nor yielding a tannic compound. No sugar s formed in this decomposition.

These results exhibit no analogy to those obtained in the analysis of he European gentians. Finally, Höhn remarked in chiretta, a crystal-izable, tasteless, yellow substance, but its quantity was so minute that o investigation of it could be made.

The leaves of chiretta, dried at 100° C., afforded 7·5 per cent. of ash; he stems 3·7; salts of potassium and calcium prevailing in both.

Uses—Chiretta is a pure bitter tonic, devoid of aroma and astrin-ency. In intense bitterness, it exceeds gentian, *Erythræa* and other uropean plants of the same order. It is much valued in India, but is t very extensively used in England, and not at all on the Continent. is said to be employed when cheap, in place of gentian, to impart vour to the compositions now sold as *Cattle Foods*.

Substitutes and Adulteration—Four other species of *Ophelia*, ely *O. angustifolia* Don, *O. densifolia* Griseb., *O. elegans* Wight, and *multiflora* Dalz., two or three species of *Exacum*, besides *Andro-phis paniculata* Wall. (p. 424), are more or less known in the Indian ears by the name of *Chiretta*[2] and possess to a greater or less degree he bitter tonic properties of that drug. Another *Gentianacea*, *Slevogtia rientalis* Griseb., is called *Chota Chiretta*, i.e. *small chiretta*. It would ceed due limits were we to describe each of these plants: we have refore given a somewhat detailed description of the true chiretta, ich will suffice for its identification. We have frequently examined chiretta found in the English market, but have never met with any her than the legitimate sort.[3]

[1] For full details, see *Archiv der Pharmac.*, 189 (1869) 229.

[2] Moodeen Sheriff, *Suppl. to the Pharmacopœia of India*, 1869. pp. 138. 189.—Con-lt also *Pharmacopœia of India*, 1868. pp. 8-9.

[3] Mr. E. A. Webb has pointed out a case of false-packing in which the roots of *Rubia cordifolia* L. (*Munjit*) had been enclosed in the bundles of chiretta.

CONVOLVULACEÆ.

SCAMMONIUM.

Scammony; F. *Scammonée*; G. *Scammonium.*

Botanical Origin—*Convolvulus Scammonia* L., a twining plant r resembling the common *C. arvensis* of Europe, but differing from being of larger size, and having a stout tap-root. It occurs in waste b places in Syria, Asia Minor, Greece, the Greek Islands, extending n ward to the Crimea and Southern Russia, but appears to be wantin Northern Africa, Italy, and in all the western parts of the Mediterra basin.

History—The dried milky juice of the scammony plant has known as a medicine from very ancient times. Theophrastus in th century B.C. was acquainted with it; it was likewise familiar to Diosco Pliny, Celsus, and Rufus of Ephesus, each of whom has given account of the manner in which it was collected. The Arabian p cians also knew scammony and the plant from which it is derived. drug was used in Britain in the 10th and 11th centuries, and w appear to be one of the medicines recommended to King Alfre Great, by Helias, patriarch of Jerusalem.[1] It is repeatedly named i medical writings in use prior to the Norman conquest (A.D. 106 one of which, directions are given for recognizing the goodness o drug by the white emulsion it produces when wetted.

The botanists of the 16th and 17th centuries, as Bru els, G Matthiolus, Dodonæus, and the Bauhins described and figured the partly under the name of *Scammonia Syriaca.* The collecting o drug was well described by Russell, an English physician of A (1752), whose account[2] is accompanied by an excellent figure r senting the plant and the means of obtaining its juice.

Scammony was formerly distinguished by the names *Alepp Smyrna*, the former sort being twice or thrice as costly as the latte the present day, Aleppo scammony has quite lost its pre-eminence.

Localities producing the drug—Scammony is collected in Minor, from Brussa and Boli in the north, to Macri and Adalia i south, and eastward as far as Angora. But the most productive loca within this area, are the valley of the Mendereh, south of Smyrna: the districts of Kirkagach and Demirjik, north of that town. neighbourhood of Aleppo likewise affords the drug. A little is obt further south in Syria, from the woody hills and valleys about the of Tiberias and Mount Carmel.

Production—The scammony plant has a long woody root, w throws off downwards a few lateral branches, and produces fro knotty summit, numerous twining stems which are persistent and w

[1] Such is the opinion expressed by the Rev. O. Cockayne. The letter of Helias to Alfred is imperfect, and mentions only balsam, petroleum, theriaka, and a white stone used as a charm. But from the reference to these four articles in another part of the MS., in connexion with scammony, ammoniacum, tragacanth, and galbanum, there is ground for believing that the latter (Syrian and Persian) drugs were included in the le of the patriarch's letter.—See *Leo Wortcunning* and *Starcraft of Early E* edited by Cockayne (Master of the Series), vol. ii. pages xxiv. 289. 17 273. 281.

[2] *Medical Observations and Inqu* (1757) 12.

base. In plants of three or four years old, the root may be an r more in diameter; in older specimens it sometimes acquires a ter of three or four inches. In length, it is from two to three feet, ling to the depth of soil in which it grows. When the root is led, there exudes a milky juice which dries up to a golden-brown, arent, gummy-looking substance:—this is *pure scammony.*[1]

e method followed in collecting scammony for use, appears to be the same in all localities. It has been thus described to us by ye-witnesses, both long resident in the East.[2] Operations com- by clearing away the bushes among which the plant is commonly ; the soil around the latter is then removed, so as to leave 4 or 5 of the root exposed. This is then cut off in a slanting direction 4 inches below the crown, and a mussel-shell is stuck into it just h the lowest edge, so as to receive the milky sap which instantly out. The shells are usually left till evening, when they are collected, e cut part of the root scraped with a knife, so as to remove any ly dried drops of juice. These latter are called by the Smyrna ts, *kaimak* or cream, the softer contents of the shell being called r milk.

metimes the scammony is allowed to dry in the shell, and such e regarded as representing the drug in its utmost perfection. But ony in shells is not brought into commerce, though a little of it is d by the peasants for their own use.

e contents of the shells and the scraped-off drops are next emptied covered copper pot or a leathern bag, carried home, made homo- s by mixing with a knife, and at once allowed to dry. In this way, of scammony is obtained closely approaching that dried in the But it is a quality of exceptional goodness. Usually the peasant ot dry off the juice promptly, but allows his daily gatherings to ulate; and when he has collected a pound or two, he places it in nshine to soften, and then kneads it, sometimes with the addition ttle water, into a plastic mass, which he lastly allows to dry. By ng exposure to heat, and retention in a liquid state, the scam- juice undergoes fermentation, acquires a strong cheesy odour and olour, and when finally dried, exhibits a more or less porous or structure, never observable in shell scammony.

ammony is very extensively adulterated. The adulteration is often ned by the peasants, who mix foreign substances into the drug it is yet soft; and it is also effected by the dealers, some of whom se it of the peasants in a half-dried state. The substances used histication are numerous, the commonest and most easily detected according to our experience, carbonate of lime and flour. Wood- earth (not always calcareous), gum arabic, and tragacanth are also red; more rarely, wax, yolk of egg, pounded scammony roots, rosin, k-lead.

scription—The pure juice of the root, simply dried by exposure sun and air, is an amorphous, transparent, brittle substance, of

ed probably from Σκάμμα, a *trench* n allusion to the excavation made he root.

one was the late Mr. S. H. Maltass na, whose interesting paper may be found in *Pharm. Journ.* xiii. (1854) 264; the other is Mr. Edward T. Rogers, formerly of Caiffa, now (1874) British Consul at Cairo.

resinous aspect, a yellowish-brown colour, and glossy fracture. Scammo possessing these characters is occasionally met with in the form flattish irregular masses, about ½ to ¾ of an inch in thickness, very brit by reason of internal fissures, yet with but few air-cavities. In mass, is of a chestnut-brown, but in small fragments it is seen to be very pa yellowish-brown and transparent, with the freshly fractured surfa vitreous and shining. When powdered, it is of a very light b Rubbed with the moistened finger, it forms a white emulsion. Treat with ether, it yields 88 to 90 per cent. of soluble matter, and a new colourless residuum. This scammony as well as the pure juice in t shell, is very liable to become mouldy; but besides this, it throws out long kept, a white, mammillated, crystalline efflorescence, the nature which we have not been able to determine. But if scammony is k quite dry, neither mouldiness nor efflorescence makes its appearance.

The ordinary fine scammony of commerce, known as *Virgin Sca mony*, is also in large flat pieces or irregular flattened lumps and fragme which in mass have a dark-grey or blackish hue. Viewed in thin fragme it is seen to be translucent and of a yellowish-brown. It is very eas broken, exhibits a shining fracture, gives an ashy grey powder, and ha peculiar cheesy odour. Some of the pieces have a porous, bub structure, indicative of fermentation; the more solid, often show t efflorescence already mentioned. Scammony has not much taste, l leaves an acrid sensation in the throat.

Chemical Composition—Scammony owes its active properties a medicine, to a resin shown (1860) by Spirgatis to be identical w that found in the root of the Mexican *Ipomœa Orizabensis*, known commerce as *Male Jalap:* this resin called *Jalapin* will be described the next article. The other constituents of pure scammony are not w known. One of them is the substance which, as already stated, ma its appearance as small masses of cauliflower crystals on the surface pure scammony, when the latter is kept in air not perfectly dry.

Whether the odour observable in commercial scammony is due t volatile fatty acid developed by fermentation, is a question still to investigated.

Commerce—The export of scammony from Smyrna amounted 1871, to 278 cases, valued at £8320; in 1872 to 185 cases value £61 According to a report of Consul Skene on the trade of Northern Syr 737 cases of scammony were exported from the province of Aleppo 1872,—six-sevenths of the quantity being for England.

Uses—Employed as an active cathartic, often in combination w colocynth and calomel.

Adulteration—Scammony is very often imported in an adultera state, but the adulteration is so clumsily effected, and is so easily d coverable by simple tests, or even by ocular examination, that drugg have but little excuse for accepting a bad article.

We have already named the substances used in the sophisticatio scammony: of these, the most frequent are carbonate of lime a farinaceous matter. The first may generally be recognized by examin the fractured surface of the drug with a good lens, when the white parti

[1] Presented to Parliament, July 1873.

f the carbonate will be perceived. If the surface is then touched hile still *sub lente*) with hydrochloric acid, effervescence will prove the esence of a carbonate. Other earthy adulterants can be discovered by cineration, or by examining the residue of the drug after treatment ith ether. Starchy substances, the presence of which may be surmised y the scammony being difficult to break, are detectable by the microscope or by solution of iodine, a cold decoction of scammony not being ected by that reagent. Scammony that is ponderous, dull and clayey, ot easily broken in the fingers, or which when broken does not exhibit clean, glossy surface, or which does not afford at least 80 per cent. of atter soluble in ether, should be rejected. That which is made up in he form of hard, dark, circular cakes is widely different from pure cammony.

Scammony may be distinguished from *Resin of Scammony* by its roperty of forming an emulsion when wetted. The resin is also more lossy and almost entirely soluble in ether.

Radix Scammoniæ.

The frauds commonly practised on the scammony of commerce, have iven rise to various schemes for obtaining the drug in a purer form, as ell as at a more moderate price.[1]

So far back as 1839, the Edinburgh College prescribed a *Resina cammonii*, which was prepared by exhausting scammony with spirit of ine, distilling off the spirit, and washing the residue with water. Such n extract was manufactured by the late Mr. Maltass of Smyrna, and easionally shipped to London.

In consequence of a suggestion made by Mr. Clark, manufacturer of quorice at Sochia near Scala Nuova, a patent was taken out (1856) by of. A. W. Williamson of London, for preparing this resin directly from e dried root by means of alcohol. The same chemist shortly afterards devised an improved process, which consists in boiling the roots st with water and then with dilute acid, so as to deprive them of all atters soluble in those menstrua, and afterwards extracting the resin y alcohol.

Resin of Scammony, obtained either from scammony or from the ied root, is ordered in the *British Pharmacopœia* of 1867, and is anufactured by a few houses. It is a brown, translucent, brittle subance of resinous fracture, entirely soluble in ether, and not forming emulsion when wetted with water.

Scammony root is occasionally brought into the London market, metimes in rather large quantity,[2] but it is not generally kept by druggists, nor do we find it quoted in price-currents. Its collection is even pposed in some parts of Turkey by the local authorities.[3]

The root consists of stout, woody, cylindrical pieces, often spirally isted, 2 to 3 inches in diameter, covered with a rough, furrowed, eyish-brown bark. They are internally pale brown, tough and resinous, ith a faint odour and taste resembling jalap. A good sample yielded 5½ per. cent. of resin.

[1] Scammony is quoted in a London price-rent, April, 1874, at 8*s.* to 36*s.* per lb.—ain of Scammony at 14*s.* per lb.

[2] Than 100 bales were offered in a drug ie, 3 July, 1873.

[3] Such was the case at Aleppo, as we know by a private letter from Mr. Consul Skene.—D. H.

RADIX JALAPÆ.

Tuber Jalapæ; Jalap, Vera Cruz Jalap; F. *Racine de Jalap;* G. *Je*

Botanical Origin—*Ipomœa Purga* Hayne (*Convolvulus Purga* deroth, *Exogonium Purga* Bentham), a tuberous-rooted plant, thro out herbaceous, twining stems, clothed with cordate-acuminate, sh auricled leaves, and bearing elegant salver-shaped, deep pink flowers grows naturally on the eastern declivities of the Mexican Andes, at a vation above the sea of 5000 to 8000 feet, especially about Chiconq and the adjacent villages, and also around San Salvador on the ea slope of the Cofre de Perote. In these localities where rain falls al daily, and where the diurnal temperature varies from 15° to 2 (60° to 75° F.), the plant occurs in shady woods, flourishing in a rich vegetable soil.

The jalap grows freely in the south of England, if planted sheltered border, but its flowers are produced so late in autum they rarely expand, and the tubers which develope in some abun are liable to be destroyed in winter unless protected from frost.

The plant has been introduced on the Neilgherry Hills in the of India; it succeeds there remarkably well,[1] and might be exten propagated if there were any adequate inducement.

History—The use as a purgative of the tuber of a convolvul plant of Mexico, was made known by the early Spanish voyagers so highly was the new drug esteemed that large quantities of it re Europe during the 16th century.

Monardes writing in 1565, says the new drug was called *Ru de las Indias* or *Ruybarbo de Mechoacan,* the latter name being gi allusion to the province of Michoacan whence the supplies were de Some writers have advanced the opinion that mechoacan root w modern jalap, but in this we do not concur, for the description gi mechoacan and the place of its production do not apply well to Both drugs were moreover well known about 1610; they were pe distinguished by Colin an apothecary of Lyons (1619), who me jalap (" *racine de Ialap*") as then newly brought to France.[2] The however often confounded, or at least only distinguished by their ence of tint. Thus jalap which at that period used to be import into transverse slices,[3] was termed from its darker colour, *Black Mech* and on the other hand, the paler mechoacan was in later times l as *White Jalap.*

Mechoacan root is now known to consist (at least in part) large thick tuber of *Ipomœa Jalapa* Pursh (*Batatas Jalapa* Ch plant of the Southern United States and Mexico. As a drug, it ha long obsolete in Europe, having given place to jalap which is active and efficient purgative.

The botanical source of jalap was not definitely ascertained about the year 1829, when Dr. Coxe of Philadelphia published a d

[1] Thus at Ootacamund, Mr. Broughton, in a letter to one of us (15 January, 1870), speaks of receiving "a cluster of tubers" weighing over 9 lb., and remarks that the plant grows as easily as a yam.

[2] Monardes, *Hist. des Médicam* par Colin, ed. 2. 1619. 131.—The f tion of this work seems to be unkno

[3] Hill, *History of the Mat. Med.* 1751. 549.

ıd coloured figure, taken from living plants sent to him two years ısly from Mexico.[1]

ınner of Growth—Though we have cultivated the jalap plant ny years, we have had no opportunity of examining the seedling, dging from analogy suppose that it has at first a small tap-root gradually thickens after the manner of a radish. A root of jalap, by some *tuber* and by others *tubercule*, throws out in addition to stems, slender, prostrate, underground shoots which emit roots at ls. These roots while but an inch or two long, become thickened rrot-shaped, gradually enlarging into napiform tuber-like bodies, emit a few rootlets from their surface and taper off below in long, r ramifications. The thickened roots have no trace of leaf-organs; ial stem grows from the shoot from which they originated.
esh jalap roots (tubers) are externally rough and dark brown, ılly white and fleshy.

llection—Jalap is said to be dug up in Mexico during the whole The smaller roots are dried entire; the larger are cut transversely, gashed so that they may dry more easily. As drying by sun-heat be almost impracticable owing to the wetness of the climate, the ıre placed in a net, and suspended over the almost constantly g hearth of the Indian's hut, where they gradually dry, and at the ime often contract a smoky smell. Much of the jalap that has of ived, has been more freely sliced than usual, and has obviously ried with less difficulty.
cording to Schiede, whose account was written in 1829,[3] the Indians onquiaco were at that period commencing the cultivation of jalap r gardens.

scription—The jalap of commerce consists of irregular, ovoid arying from the size of an egg to that of a hazel-nut, but occa- y as large as a man's fist. They are usually pointed at the lower eply wrinkled, contorted and furrowed, and of a dark-brown hue, over with numerous little, elongated, lighter coloured scars, g transversely. The large roots are incised lengthwise, or cut ılves or quarters, but the smaller are usually entire. Some of all roots are spindle-shaped or cylindrical; others can be found are nearly globular, smooth and pitchy-looking, but these latter lom solid. Good jalap is ponderous, tough, hard and often horny, ng brittle when long kept, and breaking with a resinous, non- fracture; internally it is of a pale dingy brown or dirty white. It aint smoky, rather coffee-like odour, and a mawkish taste followed dity.

croscopic Structure—Seen in transverse section, jalap exhibits liate structure, but numerous small concentric rings, which in ıieces are very regularly arranged. They are due to the latici- cells, differing from the surrounding parenchyme only by their

rican Journal of Med. Sciences, v. 0. pl. 1-2.

plain that such a proceeding is The roots should be dug up aerial stems have died down.

[3] *Linnæa*, iii. (1830) 473; *Pharm. Journ.* viii. (1867) 652.—We are not aware of any more recent account.

contents and rather larger size. These laticiferous cells trave tissue in a vertical direction, constituting vertical bands, as n observed on a longitudinal section; the single cells are simply one on the other, and do not form peculiar ducts as in *Lact Taraxacum*.

The fibro-vascular bundles of jalap are neither numerous nor they are accompanied by thin-walled cells, so that firm woody r not occur. Parenchymatous cells are abundant, and, on a longit fracture especially if subsequently moistened, are seen to constitut centric layers. The laticiferous cells are always found in the out of each layer. The suberous coat with which the drug is cove made up of the usual tabular cells.

The parenchyme of jalap is loaded with starch grains; in the which have been submitted to heat in order to dry them, the appears as an amorphous mass, and the drug then exhibits a consistence and greyish fracture, instead of being mealy. Cry calcium oxalate are frequently met with. The laticiferous cells c the resin of jalap in a semi-fluid state, even in the dry drug; d the resinous emulsion flow out of the cells, if thin slices are moi by any watery liquid.

Chemical Composition—Jalap owes its medicinal efficac resin, which is extractable by exhausting the drug with spirit o concentrating the alcoholic solution to a small bulk, and pouring water. The resin precipitated in this manner is then washed and it is contained in jalap to the extent of 12 to 18 per cent.[1]

From this crude resin, which is the *Resina jalapæ* of the p copœias, ether or chloroform extracts 5 to 7 (12, Umney) per cen resin which, according to Kayser[2] partially solidifies when in conta water in crystalline needles. We can by no means confirm K statement. The residue (insoluble in ether) is one of the substa which the name *Jalapin* has been applied.[3] W. Mayer, 1852–185 designated it *Convolvulin*,[4] found it to have the composition, C^{31} When purified, it is colourless; it dissolves easily in the fixed alka is not re-precipitated by acids, having been converted by assum water into amorphous *Convolvulic Acid*, which is readily soluble in Both convolvulin and convolvulic acid are resolved by moderate with dilute acids, or with emulsin, into crystallizable *Conv* $C^{26}H^{50}O^{7}$, and sugar. Convolvulinol in contact with aqueous al converted into *Convolvulinolic Acid*, $C^{26}H^{48}O^{6}$, which is slightly sol water and crystallizable.

When convolvulin or its derivatives is treated with nitric aci is produced, together with oxalic acid, a body which has been *Ipomœic Acid*, $C^{10}H^{18}O^{4}$, isomeric with sebacic acid.

Convolvulin (dry) melts at 150° C, but a small amount of water

[1] Guibourt obtained of it 17 per cent., Umney 21·5, Squibb 11 to 16, T. and H. Smith "not more than 15," D. Hanbury 11 to 15·8. Jalap grown in Bonn, afforded to Marquart 12 per cent.; a root cultivated at Munich gave Widnmann 22 per cent.; from plants produced in Dublin, W. G. Smith got 9 to 12 per cent.; and fine tubers from Ootacamund in India yielded to one of us 18 per cent. of resin. Broughton is o that exposure of the sliced tuber to the process of drying, favours the f of resin, by the oxidation of a hyd

[2] Gmelin, *Chemistry*, xvi. (1864

[3] As by Pereira, *Elem. of Mat.* (1850) 1463.

[4] Gmelin, op. cit. xvi. 154.

; fusible below 100° C. It is insoluble in oil of turpentine and in mmonia. It dissolves in dilute nitric acid without becoming coloured r evolving gas. Convolvulin possesses in a high degree the purgative roperty of jalap, but this is not the case with convolvulinol.

The other constituents of jalap include starch, uncrystallizable sugar, um, and colouring matter. The sugar according to Guibourt, exists to e extent of 19 per cent.

Commerce—We have no means of knowing to what extent jalap is roduced in Mexico. The imports of the drug into the United Kingdom, mounted in 1870 to 169,951 lb. Very considerable quantities have of ate (1873) appeared in the London drug-sales.

Uses—Jalap is employed as a brisk cathartic.

Other kinds of Jalap.

Besides true jalap, the roots of certain other *Convolvulaceæ* of Mexico ave been employed in Europe, either in the form of jalapin, or as adulrants of the more costly, legitimate drug. The two following have been ntensively imported and have been traced to their botanical source; but here are others, of more occasional occurrence, the origin of which has ot been ascertained.[1]

1. *Light, Fusiform*, or *Woody Jalap, Male Jalap, Orizaba Root, Jalap ips* or *Stalks, Purgo macho* of the Mexicans.

This drug is derived from *Ipomœa Orizabensis* Ledanois,[2] a plant of rizaba, which is but imperfectly known. It is described as a pubescent mber, having a spindle-shaped root about 2 feet long, of woody and rous texture. The drug occurs in irregular, rectangular, or block-like ces, evidently portions of a very large root, divided transversely and gitudinally. Sometimes it is more like true jalap, being in entire ts, of smaller size, spindle-shaped, not spherical. It has a somewhat ter colour than jalap, and much deeper longitudinal wrinkles. The er pieces often exhibit deep cuts from an axe or knife; transverse es are of rare occurrence. Although generally less ponderous than ap, the Orizaba drug is nevertheless of a compact and often horny ture. From jalap it is easily distinguished by its radiated transverse tion, and the numerous thick bundles of vessels which project as ody fibres from the fractured surface.

In chemical constitution, Orizaba root is closely parallel to jalap. e resin was named by Mayer *Jalapin*;[3] it is the *Jalapin* of Gmelin's *emistry* (xvi. 405), and perhaps the jalapin of English pharmacy.[4]

In the pure state, it is a colourless amorphous translucent resin, *dis-ving perfectly in ether*, thus differing from convolvulin the correspond-g resin of jalap. We find that it is readily soluble also in acetone, ylic alcohol, benzol and phenol, not in bisulphide of carbon. It has composition $C^{34}H^{56}O^{16}$, so that it is homologous with convolvulin; decomposition-products of jalapin obtained by similar treatment,

[1] For information about some of these, ult Guibourt, *Histoire des Drogues*, ii.) 523.

[2] *Journ. de Chimie méd.* x. (1834) 1·22. 1. 2.

[3] The name is ill-chosen and misleading, it having been adopted in standard works, it might occasion greater confusion to attempt to supersede it, and its several derivatives.

[4] It is at least a fact, that of numerous samples of jalapin that we have examined (1871), every one is *completely soluble in ether*.

namely jalapic acid, jalapinol, and jalapinolic acid, are likewise hom logous with the corresponding substances obtained from convolvul All these bodies when treated with nitric acid, yield ipomœic ac Jalapin has the same fusing point as convolvulin, and behaves in t same manner with alkalis.

The root afforded us 11·8 per cent. of resin dried at 100° C. Wh perfectly washed, decolorized and dissolved in two parts of alcohol, t resin turned the plane of polarization of a ray of light 9·8° to the left a column of 50 mm. long. Convolvulin under the same conditions turn it only 5·8°. The resin of Orizaba root is held by chemists to be ident with that of scammony, of which it has the drastic action.

2. *Tampico Jalap,—Purga de Sierra Gorda* of the Mexicans—' plant which affords this drug has been described by one of us (18 under the name of *Ipomœa simulans.*[1] It is closely related to *I. Pe* Hayne, from which by its foliage it cannot be distinguished, but it h *bell-shaped corolla* and *pendulous flowerbuds,* which are very diffe *I. simulans* Hanbury, grows in Mexico along the mountain range of Sierra Gorda in the neighbourhood of San Luis de la Paz, from wh town and the adjacent villages, its roots are carried down to Tamp It has also been found on the lofty Cordillera near Oaxaca, but whe there collected we know not.

The drug, to which in trade the name *Tampico Jalap* is comm applied, has been imported during the last few years in consider quantities. In appearance it closely approaches true jalap, but the are generally smaller, more elongated or finger-like, more shrivelled corky-looking, wanting in the little transverse scars that are plenti scattered over the roots of true jalap. Many pieces occur however w it is impossible to distinguish by the eye from true jalap, with whi agrees also in odour and taste.

Tampico jalap yielded to one of us, 10 per cent. of *purified* entirely soluble in ether. Umney[2] obtained 12 to 15 per cent. of almost wholly soluble in ether; Evans got 13 per cent., but found about half of this to be soluble in ether.[3] According to Andouard resin of Tampico jalap is not deficient in purgative powers.

SEMEN KALADANÆ.

Semen Pharbitidis; Kaladana.

Botanical Origin—*Pharbitis Nil*[5] Choisy (*Convolvulus Nil* twining annual plant, with a large blue corolla, much resembling Major Convolvulus (*Pharbitis hispida* Chois.) of English gardens having three-lobed leaves. It is found throughout the tropical re of both hemispheres, and is common in India, ascending the moun to a height of 5000 feet.

[1] Hanbury, On a species of *Ipomœa*, affording Tampico Jalap, *Journ. of Linn. Soc.*, Bot. xi. (1871) 279, tab. 2; *Pharm. Journ.* xi. (1870) 848; *American Journ. of Pharm.* xviii. (1870) 330.

[2] *Pharm. Journ.* ix. (1868) 282.

[3] Ibid. ix. (1868) 330.

[4] *Etude sur les Convolvulacées* (thèse) Paris, 1864. 31.

[5] *Pharbitis* from Φαρβίς *colour*, in al to the flower. In Hindustani *Nil* *blue*, and *Kala-dana*, black seed.

History—The seeds of this plant were employed in medicine by the ibian physicians under the name *Habbun-nîl;* and they have probably n long in use among the natives of Hindustan. In recent times y have been recommended by O'Shaughnessy, Kirkpatrick, Bidie, ring[1] and many other European practitioners in India, as a safe and cient cathartic.

Description—The shape of the seeds is that which would result if nearly spherical body were divided perpendicularly around its axis o 6 or 8 almost equal segments, only that the back is less regularly ulted. The seeds are ¼ of an inch high and nearly as much broad; 0 of them weigh on an average about 6 grammes. There is a smaller riety imported from Calcutta, of which 100 seeds weigh but little over grammes; in every other respect the two sorts are identical. Both of a dull black, excepting at the umbilicus which is brown and newhat hairy. The adjacent parts of the thin shell (testa) crack in rious directions, if the seed is kept for a short time in cold water. If is removed from the upper part of the vaulted back, the radicle becomes ible, surrounded by the undulated folds of the cotyledons, which join pendicularly, but cannot be easily unfolded by reason of the thin minal integument. Cut transversely, the cotyledons show the same ded structure. Throughout their tissue, small bright glands in siderable number are observable, even without a lens. The kernel, ich is devoid of albumen, has at first a nutty taste, with subsequently disagreeable persistent acridity. When bruised in a mortar, the seeds lve a heavy earthy smell.

Microscopic Structure—The seed is covered with a dark blackish icle, formed of a densely packed tissue, the cells of which show zag outlines. The dark brown epidermis is composed of very close indrical cells, about 70 mkm. in length and 5 to 7 mkm. in diameter; y require to be treated with chromic acid in order that their structure y be distinctly seen.

The tissue of the kernels is made up of thick-walled cells. Between s tissue and the shell, there is a colourless layer, about 70 mkm. ck, of thin-walled corky parenchyme. The cotyledons contain in ir narrow tissue, numerous granules of albuminous matter, mucilage, little tannic acid, crystals of oxalate of calcium, and a few starch nules. The glands or hollows, before alluded to as occurring through- the tissue of the cotyledons, are about 70 mkm. in diameter, and tain an oily liquid.

Chemical Composition—By exhausting the seeds dried at 100° C. h boiling ether, we obtained a thick light-brownish oil having an d taste and concreting below 18° C. The powdered seeds yielded this oil 14·4 per cent. Water removes from the seeds a considerable ount of mucilage, some albuminous matter and a little tannic acid. e first is soluble to some extent in dilute spirit of wine, and may be cipitated therefrom by an alcoholic solution of acetate of lead.

The active principle of kaladana is a *resin*, soluble in alcohol, but ther in benzol nor in ether. From the residue of the seeds after nustion by ether, treatment with absolute alcohol removed a pale lowish resin in quantity equivalent to 8·2 per cent. of the seed.

[1] *Pharm. Journ.* vii. (1866) 496.

Kaladana resin, which has been introduced into medical prac India under the name of *Pharbitisin*,[1] has a nauseous acrid taste a unpleasant odour, especially when heated. It melts about 160° C. following liquids dissolve it more or less freely, namely, spirit of absolute alcohol, acetic acid, glacial acetic acid, acetone, acetic methylic and amylic alcohol, and alkaline solutions. It is on the hand insoluble in ether, benzol, chloroform, and sulphide of c With concentrated sulphuric acid, it forms a brownish yellow so quickly assuming a violet hue. This reaction however requires small quantity of the powdered resin. If a solution of the re ammonia, after having been kept a short time, is acidulated, no p tate is formed; but the solution is now capable of separating pr of copper from an alkaline solution of the tartrate, which origi did not alter. Heated with nitric acid, the resin affords *Ipomœic Acid.*

From these reactions of kaladana resin, we are entitled to inf it agrees with the resin of jalap or *Convolvulin.* To prepar quantity, it would probably be best to treat the seeds with commo acid, and to precipitate it by neutralizing the solution. We have tained that the resin is not decomposed when digested with acetic acid at 100° C., even for a week.

We have had the opportunity of examing a sample of kaladan manufactured by Messrs. Rogers and Co., chemists of Bombay and which we found to agree with that prepared by ourselves. It is yellowish friable mass, resembling purified jalap resin, and like it, of being perfectly decolorized by treatment with animal charcoal.

Uses—Kaladana seeds have cathartic powers like jalap. Besi resin, an extract, tincture and compound powder have been intr into the *Pharmacopœia of India.* In many parts of India the take the roasted seeds as a purgative.

SOLANACEÆ.

STIPES DULCAMARÆ.

Caules Dulcamaræ; Bitter-sweet, Dulcamara, Woody Nightsha F. *Douce amère, Morelle grimpante;* G. *Bittersüss.*

Botanical Origin—*Solanum Dulcamara* L., a perennial s plant, having small purple flowers and red berries, occurring thro Europe, except in the extreme north. It is also found in N Africa, and in Asia Minor, and has become naturalized in North A It is common in moist, shady hedges and thickets.[2]

History—The stalks of bitter-sweet were introduced into practice by the German physicians and botanists of the 16th c one of whom, Tragus (1552), has figured and described it, un name of *Dulcis amara* or *Dulcamarum.*

[1] *Pharmacopœia of India*, 1868. 156.

[2] *Solanum nigrum* L. which slightly resembles dulcamara, is a low-growing annual or biennial, with *herbaceous* stems, ries usually *black.*

Description—The older stems are woody; the upper and younger soft and green, long and straggling, attaining by the support of other nts, a height of 6 feet or more, and dying back in the winter. For dicinal use, the shoots of a year or two old should be gathered, either e in the year, or early in the spring before the leaves come out. ese shoots are several feet long, by about ½ of an inch thick, of a light enish-brown, sometimes cylindrical, at others indistinctly 4- or 5-sided, ghtly furrowed longitudinally, or somewhat warty.

The thin, shining cork-bark easily exfoliates, showing beneath it the sophloeum which is rich in chlorophyll. The stalks are mostly hollow, l partially filled with a whitish pith. The wood when dried is about f or one-third as broad as the hollow centre, and the green bark conerably narrower than the wood; the latter has a radiate structure, l in older stems exhibits two or three sharply-defined annual rings. e stems are usually cut into short lengths before being dried for use.

The odour which is rather fœtid and unpleasant, is to a great extent sipated by drying. The taste at first slightly bitter, is afterwards etish. The bitter appears to be more predominant in the spring than he autumn.

Microscopic Structure—The epidermis of younger shoots consists tabular thick-walled cells, many of them being elevated from the face as short blunt hairs. The older stems are covered with the usual erous envelope. The boundary between the mesophloeum and the ophloeum is marked by a ring of strong liber fibres, some of which occur in the pith. The woody part is rich in large vessels. In parenchymatous tissue of bitter-sweet, small crystals of oxalate of ium, not of a well-defined outline, and minute starch granules are osited.

Chemical Composition—The taste of bitter-sweet appears due, rding to Schoonbroodt (1867), to a bitter principle yielding by deposition, sugar and *Solanine*,—the latter in very small amount. anine is an alkaloid; it was first prepared in 1820 by Desfosses from berries of *Solanum nigrum* L., and was subsequently detected by same chemist in the leaves and stalks of *S. Dulcamara*, and by chier in the berries. Winckler (1841) observed that the alkaloid of camara stems can be obtained only in an amorphous state, and that ehaves to platinic and mercuric chlorides differently from the sola- e of potatoes. Moitessier (1856) confirmed this observation, and ained only amorphous salts of the solanine of bitter-sweet.

Zwenger and Kind on the one hand, and O. Gmelin on the other 59 and 1858), found that solanine, $C^{43}H^{63}NO^{16}$, is a conjugated comnd of sugar and a peculiar crystallizable alkaloid, *Solanidine*, $H^{32}NO$. The latter, under the influence of strong hydrochloric acid, s up water, and is converted into the amorphous and likewise basic pound, *Solanicine*, $C^{50}H^{78}N^{2}O$.

Lastly, Wittstein (1852) detected in the stems of bitter-sweet another rphous alkaloid, *Dulcamarine*, which has a bitter-sweet taste, but ers in its reactions both from the solanine of potatoes and from that ined by Winckler from dulcamara. It exists to the extent of cely $\frac{1}{10}$ per cent.

Uses—Dulcamara is occasionally given in the form of decoction, in

rheumatic or cutaneous affections; but its real action, according to Garrod, is unknown. This physician remarks[1] that it does not dilate the pupil or produce dryness of the throat like belladonna, henbane or stramonium. He has given to a patient 3 pints of the decoction *per diem* without any marked action, and has also administered as much as half a pound of the fresh berries with no ill effect.

FRUCTUS CAPSICI.

Pod Pepper, Red Pepper, Guinea Pepper, Chillies, Capsicum; F. *Piment ou Corail des Jardins, Poivre d'Inde ou de Guinée;* G. *Spanischer Pfeffer.*

Botanical Origin—The plants, the fruits of which are known as *Pod Pepper*, have for a long period been cultivated in tropical countries, and are now found in such numerous varieties, that an exact determination of the original species is a point of great difficulty. Of several species having pungent fruits, the two following are those which supply the spice found in British commerce :—

1. *Capsicum fastigiatum* Blume,[2] a small ramous shrub, with 4-sided, fastigiate, diverging branches; fruit-bearing peduncles sub-geminate, slender, erect; fruit very small, subcylindrical, oblong, straight, with calyx obconical and truncate. It occurs apparently wild in Southern India, and is extensively cultivated in Tropical Africa and America.

Roxburgh, who describes this plant under the name *C. minimum*, terms it *East Indian Bird Chilly* or *Cayenne Pepper Capsicum*. Wight says that it is consumed by the natives of India, but that it is not the sort preferred. It is this species that the authors of the British Pharmacopœia have cited as the source of the *Fructus Capsici* to be used in medicine, and it certainly furnishes the greater part of the Pod Pepper now found in the London market.

2. *C. annuum* L., an herbaceous (sometimes shrubby ?) plant, with fruit extremely variable in size, form and colour, in some varieties erect, in others pendulous. According to Naudin, in whose opinion we concur, *C. longum* DC.[3] and *C. grossum* Willd. are not specifically distinct from this plant. It furnishes the larger kinds of Pod Pepper and, as we believe, much of the Cayenne Pepper which is imported in the state of powder.

History—All species of *Capsicum* appear to be of American origin: no ancient Sanskrit or Chinese name for the genus is known, and the Latin and Greek names that have been referred to it, are extremely doubtful.[4]

The earliest reference to the fruit as a condiment that we have met with, occurs in a letter written in 1494 to the Chapter of Seville by Chanca, physician to the fleet of Columbus in his second voyage to the

[1] *Essentials of Materia Medica*, 1855. 196.

[2] Wight, *Icones Plant. Indiæ Orient.* iv. (1850) tab. 1617; *Capsicum minimum* Roxb. *Flor. Ind.* i. (1832) 574. Farre has ascertained that this is the *Capsicum frutescens* of the *Species Plantarum* of Linnæus, but not that of the *Hortus Cliffortianus* of the same botanist, to which latter the name *C. frutescens* is usually applied.

[3] The chief distinction between *C. annuum* and *C. longum*, is that the former has an *erect*, the latter a *pendulous* fruit.

[4] Dunal in De Cand. *Prodromus*, xiii. 412.

'est Indies. The writer in noticing the productions of Hispaniola, marks that the natives live on a root called *Age*, which they season th a spice they term *Agi*, also eaten with fish and meat.[1] The first of ese words signifies *yam*, the second is the designation of Red Pepper, d still the common name for it in Spanish. Capsicum and its uses e more particularly described by Gonzalo Fernandez de Oviedo, who ached Tropical America from Spain in A.D. 1514.[2]

In the *Historia Stirpium* of Leonhard Fuchs, published at Basle in 42, may be found the first and excellent figures of *Capsicum longum* C. under the name of *Siliquastrum* or *Calicut Pepper;* the author ates that the plant had been introduced into Germany from India 'ew years previously. From this might be inferred an Indian origin; t on the other hand, Clusius asserts that the plant was brought from rnambuco by the Portuguese, whose commercial intercourse with dia would easily explain it being carried thither at an early period. e further states, that the American capsicum had been generally roduced into the gardens of Castille, and that it was used all the ar round, green or dried, as a condiment and as pepper. He also saw cultivated in abundance at Brünn in Moravia in 1585.[3]

Capsicum longum DC. was grown in England by Gerarde (1597 *et tea*), who speaks of the pods as well known, and sold "in the shops at llingsgate by the name of Ginnie Pepper."

Description—As already indicated, the Pod Pepper of commerce is two kinds, namely:—

1. Fruits of *Capsicum fastigiatum*—These are $\frac{1}{2}$ to $\frac{3}{4}$ of an inch length, by about $\frac{2}{10}$ of an inch in diameter, of an elongated, subical form, tapering to a blunt point, and slightly contracted towards e base. The calyx, which is not always present, is cup-shaped, oothed, 5-sided, supported on a slender, straight pedicel, $\frac{3}{4}$ to 1 inch g. The fruits, which are somewhat compressed and shrivelled drying, and also brittle when old, have a leathery, smooth, shining, nslucent, thin, dry pericarp, of a dull orange-red, enclosing about 18 ds, attached in two cells to a thin central partition. The seeds have e form of roundish or ovate discs, about $\frac{1}{8}$ of an inch in diameter, newhat thickened at the edges; the embryo is curved, almost into ring. The taste of the pericarp, and likewise of the seeds, is exmely pungent and fiery. The dried fruit has an odour by no means ble, which we cannot compare to that of any other substance.

2. Fruits of *Capsicum annuum* of the commonest variety, resemble se of *C. fastigiatum*, except that they are of larger size, being from o 3 or more inches in length, often rather more tapering towards the tremity. The seeds scarcely surpass in size those of *C. fastigiatum*.

Microscopic Structure—The pericarp consists of two layers, the ter being composed of yellow thick-walled cells. The inner layer is ice as broad and exhibits a soft shrunken parenchyme, traversed by n fibro-vascular bundles. The cells of the outer layer especially are

[1] *Letters of Christopher Columbus*, transd by Major (Hakluyt Society), 1870. 68.

[2] Oviedo, *Historia de las Indias* Madrid, 851 275

[3] Caroli Clusii *Curæ posteriores*, Antverp., 1611. 95.

the seat of the fine granular colouring matter. If it is removed by an alcoholic solution of potash, a cell-nucleus and drops of fat oil make their appearance. The structural details of this fruit afford interesting subjects for microscopical investigation.

Chemical Composition—Bucholz in 1816, and about the same time Braconnot, traced the acridity of capsicum to a substance called *Capsicin*. It is obtained by treating the alcoholic extract with ether, and is a thick yellowish red liquid, but slightly soluble in water. When gently heated, it becomes very fluid, and at a higher temperature is dissipated in fumes which are extremely irritating to respiration. It is evidently a mixed substance, consisting of resinous and fatty matters.

Felletár in 1869, exhausted capsicum fruits with dilute sulphuric acid, and distilled the decoction with potash. The distillate, which was strongly alkaline and smelt like conine, was saturated with sulphuric acid, evaporated to dryness, and exhausted with absolute alcohol. The solution after evaporation of the alcohol, was treated with potash, and yielded by distillation a volatile alkaloid having the odour of conine.

From experiments made by one of us (F.) we can fully confirm the observations of Felletár. We have obtained the volatile base in question, and find it to have the smell of conine. It occurs both in the pericarp and in the seeds, but in so small proportion that we were unsuccessful in isolating it in sufficient quantity to allow of accurate examination.

Dragendorff states (1871) that petroleum ether is the best solvent for the alkaloid of capsicum; he obtained crystals of its hydrochlorate, the aqueous solution of which was precipitated by most of the usual tests, but not by tannic acid.

The colouring matter of capsicum fruits is sparingly soluble in alcohol, but readily in chloroform. After evaporation, an intensely red soft mass is obtained, which is not much altered by potash.

The fruits of *Capsicum fastigiatum* have a somewhat strong odour; on distilling consecutively two quantities, each of 50 lb., we obtained a scanty amount of flocculent fatty matter, which possesses an odour suggestive of parsley. Both this matter, as well as the distilled water, were neutral to litmus paper, and the water tasteless. We separated the latter and exposed the remaining greasy mass to a temperature of about 50° C., when it for the most part melted. The clear liquid on cooling solidified, and now consisted of tufted crystals, which we further purified by recrystallization from alcohol. Thus about 2 centigrammes were obtained of a neutral white stearoptene, having a decidedly aromatic, not very persistent taste, by *no means acrid*, but rather like that of the essential oil of parsley. The crystals melted at 38° C. On keeping them for some days at the temperature of the water-bath, covered with a watch-glass, some drops of essential oil were volatilized, which had the same taste and did not solidify; the crystals were consequently accompanied by a liquid oil. When kept for some days more in that condition, the crystals themselves began to be volatilized, and the part remaining behind acquired a brownish hue. This no doubt points out another impurity, as we ascertained by the following experiment. With boiling solution of potash, the stearoptene produces a kind of soap, which on cooling yields a transparent jelly. If this is dissolved and diluted, it becomes turbid by addition of an acid. This probably

upon the presence of a little fatty matter, a suggestion which is l by the somewhat offensive smell given off by our stearoptene ated in a glass tube.

merce—Chillies or Pod Pepper are shipped from Zanzibar, Africa and Natal, but no general statistics of the quantity into Great Britain are accessible.

xports from Sierra Leone in 1871 reached 7258 lb.[1] The Natal which produces Cayenne Pepper in the county of where sugar-cane and coffee are also grown, shipped in the r 9072 lb.[2]

l returns[3] show that in 1871 Singapore imported 1071 cwt. lb.) of chillies, chiefly from Penang and Pegu. The spice is nsumed by the Chinese.

ay imported of dried chillies in the year 1872–3, 5567 cwt. lb.) principally from the Madras Presidency, and exported [4]

—Capsicum on account of its pungent properties, is often ad- l as a local stimulant in the form of gargle, and occasionally ment; and internally to promote digestion. In all warm it is much employed as a condiment.

RADIX BELLADONNÆ.

donna Root; F. *Racine de Belladone;* G. *Belladonnawurzel.*

nical Origin—*Atropa Belladonna* L., a tall, glabrous or slightly erb, with a perennial stock, native of Central and Southern here it grows in the clearings of woods. The plant extends to the Crimea, Caucasia and Northern Asia Minor. In is chiefly found in the southern counties, but even of these btful native.

few localities in England and France as well as in North the plant is cultivated for medicinal use.

ry—Although a plant so striking as belladonna can hardly unknown to the classical authors, it cannot with certainty be in their writings.

nus of Ascoli,[5] who wrote an enumeration of medicinal plants 1450, names the leaves of both *Solatrum furiale* and *Solatrum* former of which is probably *Belladonna.* However this may st indubitable notice of it that we have met with, is in the *hier* printed at Paris, probably about 1504.[6] The plant is oned about this period as *Solatrum mortale* or *Dolwurtz*, in gs of Hieronymus Brunschwyg.[7]

of the Colony of Sierra Leone

atal for 1871.

Straits Settlements for 1871.

of the Trade and Navigation 1872-73, pt. ii. 58. 91.

um Aromatariorum, 1488.

[6] *Le Grand Herbier en francoys, contenant les qualitez, vertus et proprietez des herbes,* &c., Paris (no date) 4°. cap. *De Solastro rustico.*

[7] *Das destillier Buch* (sub. voce *Nachtschet Wasser*). Strassb. 1515. But there are earlier editions.

In 1542, belladonna was well figured as *Solanum somnifer* *Dollkraut*, by the German botanist Leonhard Fuchs, who fully recog its poisonous properties.[1] Yet it was confounded by other write this period, as Tragus,[2] who reproduced Fuchs' figure as "*Sol hortense!*"

Matthiolus (1548), who terms the plant *Solanum majus*, states it is called by the Venetians *Herba Bella donna*, from the circums of the Italian ladies using a distilled water of the plant as a cos The introduction of the root of belladonna into British medici of recent date, and is due to Mr. Peter Squire of London, who r mended it as the basis of a useful anodyne liniment, about the 1860.

Description—Belladonna has a large, fleshy, tapering root, 1 inches thick, and a foot or more in length, from which diverge branches. Externally the fresh roots are of an earthy brown, with cracks and transverse ridges. The bark is thick and juicy, a well as the more fibrous central portion, is internally of a dull c white. A transverse section of the main root shows a distinct r structure. The root has an earthy smell with but very little taste

Dried root of Belladonna is sold in rough irregular pieces dirty greyish colour, whitish internally, breaking easily with a fracture, and having an earthy smell not unlike that of liquorice Roots not exceeding the thickness of the finger should be pre The drug is for the most part imported from Germany, and is of doubtful quality. English-grown root purchased in a fresh sta large and old being rejected), then washed, cut into transverse se and dried by a gentle heat, furnishes a more reliable and satis article.

Microscopic Structure—There is a considerable structural ence between the main root and its branches, the former alone con a distinct pith. This pith is included in a woody circle, traver narrow medullary rays. In the outer part of the woody circle. chymatous tissue is more prevalent than vascular bundles. transverse section of the branches of the root, exhibits a central v bundle instead of a medullary column. The outer vascular b show no regular arrangement; and medullary rays are not clearly in the transverse section.

The woody parts, both of the main root and its branches, conta large dotted vessels accompanied by a prosenchymatous tissue cells of the latter, however, are always thin-walled; the abse proper so-called ligneous tissue explains the easy fracture of th Sometimes the prosenchyme in which the vessels are imb assumes a brownish hue and a waxy appearance, and such parts a very irregular structure.

In the cortical portion of belladonna root, many of the cells middle layer, and likewise some of the central parts of the ro loaded with extremely small octahedric crystals of calcium o But most of the parenchymatous cells are filled up with small granules.

[1] *Historia Stirpium*, Basil. 1542. 689.

[2] *De Stirpium*, p. 3[illegible]1.

Chemical Composition—In 1833, Mein prepared from the root, and Geiger and Hesse from the herb, the crystallizable alkaloid *Atropine*, $C^{17}H^{23}NO^3$. The researches of Lefort (1872) have proved that the roots contain it in very variable proportions, the young being much richer in alkaloid than the old.[1] The maximum proportion obtained was 0·6 per cent.; this was from root of the thickness of the finger. Large old roots, 7 or 8 years of age, afford from 0·25 to 0·31 per cent. They have besides a smaller proportion of bark than young roots, and it is chiefly in the bark that the alkaloid appears to reside. Manufacturers of atropine employ exclusively the root.

Ludwig and Pfeiffer (1861) by decomposing atropine with potassium chromate and sulphuric acid, obtained benzoic acid and propylamine. Other products are formed when atropine is treated with strong hydrochloric acid, baryta water or caustic soda, thus—*Atropine*, $C^{17}H^{23}NO^3 + H^2O$ = *Tropic Acid*, $C^9H^{10}O^3$ + *Tropine*, $C^8H^{15}NO$.

Tropic acid crystallizes, and is easily resolved into *Atropic Acid* and *Atropic Acid*, each corresponding to the formula $C^9H^8O^2$, but otherwise remarkably dissimilar. Tropine is a strongly alkaline body, readily soluble both in water and alcohol, and furnishing tabular crystals by the evaporation of its solution in ether. Neither tropine nor tropic acid, it is stated by Kraut (1863), is present in the leaves and root of belladonna.

Hübschmann (1858) detected in belladonna root a second but uncrystallizable alkaloid, called *Belladonnine*; it has a resinous aspect, distinctly alkaline, and when heated emits, like atropine, a peculiar odour.

The root further contains according to Richter (1837) and Hübschmann, a fluorescent substance, as well as a red colouring matter called *Atrosin*.[2] The latter occurs in greatest abundance in the fruit, and would probably repay further investigation.

Uses—Belladonna root is chiefly used for the preparation of atropine, which is employed for dilating the pupil of the eye. A liniment made with belladonna root is used for the relief of neuralgic pains.

FOLIA BELLADONNÆ.

Belladonna Leaves; F. *Feuilles de Belladone*; G. *Tollkraut*.

Botanical Origin—*Atropa Belladonna* L. (p. 409).

History—Belladonna Leaves and the extract prepared from them were introduced into the London Pharmacopœia of 1809. For further particulars regarding the history of belladonna, see the preceding article.

Description—Belladonna or Deadly Nightshade produces thick, smooth herbaceous stems, which attain a height of 4 to 5 feet. They are simple in their lower part, then usually 3-forked, and afterwards 2-forked, producing in their upper branches an abundance of bright green leaves, arranged in unequal pairs, from the bases of which spring the

[1] For Lefort's process for estimating atropine, see p. 412.

[2] Gmelin, *Chemistry*, xvii. (1866) 1.

solitary, pendulous, purplish, bell-shaped flowers, and large shining black berries.

The leaves are 3 to 6 inches long, stalked, broadly ovate, acuminate, attenuated at the base, soft and juicy; those of barren roots are alternate and solitary. The young shoots are clothed with a soft, short pubescence, which on the calyx is somewhat more persistent, assuming the character of viscid, glandular hairs. If bruised, the leaves emit a somewhat offensive, herbaceous odour which is destroyed by drying. When dried, they are thin and friable, of a brownish green on the upper surface and greyish beneath, with a disagreeable, faintly bitter taste. Of fresh leaves, 100 ℔. yield 16 ℔. of dried (Squire).

Chemical Composition—The important constituent of belladonna leaves is *Atropine*. Lefort (1872)[1] estimated its amount by exhausting the leaves previously dried at 100° C. by means of dilute alcohol, concentrating the tincture, and throwing down the alkaloid with a solution of iodo-hydrargyrate of potassium. The precipitate thus obtained was calculated to contain 33·25 per cent. of atropine. Lefort examined leaves from plants both cultivated and growing wild in the environs of Paris, and gathered either before or after flowering. He found cultivation not to affect the percentage of alkaloid,—that the leaves of the young plant were rather less rich than those taken at the period of full inflorescence,—and that the latter (dried) yielded 0·44 to 0·48 per cent. of atropine.

Belladonna herb yields *Asparagine*, which according to Biltz (1863) crystallizes out of the extract after long keeping. The crystals found in the extract by Attfield (1862) were however, chloride and nitrate of potassium. The same chemist obtained by dialysis of the juice of belladonna, nitrate of potassium, and square prisms of a salt of magnesium containing some organic acid; the juice likewise affords ammonia.[2] The dried leaves yielded us 14·5 per cent. of ash consisting mainly of calcareous and alkaline carbonates.

Uses—The fresh leaves are used for making *Extractum Belladonnæ* and the dried for preparing a tincture. They should be gathered when the plant is well in flower.

HERBA STRAMONII.

Stramonium, Thornapple; F. *Herbe de Stramoine*; G. *Stechapfelkraut*.

Botanical Origin—*Datura*[3] *Stramonium* L., a large, quick-growing upright annual, with white flowers like a convolvulus, and ovoid spiny fruits. It is now found as a weed of cultivation in almost all the temperate and warmer regions of the globe. In the south of England it is often met with in rich waste ground, chiefly near gardens and habitations.

[1] *Journ. de Pharm.* xv. (1872) 269, 341.

[2] The fresh juice kept for a few days has been known to evolve *red vapours* (nitrous acid?) when the vessel containing it was opened.—H. S. Evans in *Pharm. Journ.* ix (1850) 260.

[3] *Datura* from the Sanskrit name *Dhatura*, applied to *D. fastuosa* L. The origin of the word *Stramonium* is not known to

History—The question of the native country and early distribution *D. Stramonium* has been much discussed by botanical writers. ıonse De Candolle,[1] who has ably reviewed the arguments advanced ıvour of the plant being a native respectively of Europe, America or , enounces his opinion thus:—that *D. Stramonium* L. appears to ndigenous to the Old World, probably the borders of the Caspian or adjacent regions, but certainly not of India; that it is very ɔtful if it existed in Europe in the time of the ancient Roman ɔire, but that it appears to have spread itself between that period the discovery of America.

Stramonium was cultivated in London towards the close of the 16th ury by Gerarde, who received the seed from Constantinople and ly propagated the plant, of the medicinal value of which he had a ı opinion. Its use in more recent times is due to the experiments of ck.[2]

Description—Stramonium produces a stout, upright, herbaceous n stem, which at a short distance from the ground, throws out ading forked branches, in the axil of each fork of which, arises a ary white flower, succeeded by an erect, spiny, ovoid capsule. At ı furcation and directed outwards, is a large leaf. This arrangement arts is repeated, and as the plant grows vigorously, it often becomes h branched and acquires in the course of the summer a considerable

The leaves of stramonium have long petioles, are unequal at the , oval, acuminate, sinuate-dentate with large irregular pointed teeth obes, downy when young, glabrous at maturity. When fresh, they somewhat firm and juicy, emitting when handled a disagreeable id smell. The larger leaves of plants of moderate growth, attain a gth of 6 to 8 or more inches.

For medicinal purposes, the entire plants are pulled up, the leaves l younger shoots are stripped off, quickly dried, and then broken and into short lengths, so as to be conveniently smoked in a pipe, that ng the method in which the drug is chiefly consumed in England. e offensive smell of the fresh plant is lost by drying, being replaced a rather agreeable tea-like odour. The dried herb has a bitterish ine taste.

Chemical Composition—The leaves of stramonium contain in com- n with the seeds, the alkaloid *Daturine* (see p. 414), but in extremely all proportion, not exceeding in fact, $\frac{2}{10}$ to $\frac{3}{10}$ per mille. They are h in saline and earthy constituents; selected leaves dried at 100° C. lded us 17·4 per cent. of ash.

Uses—Scarcely employed in any other way than in smoking like acco, for the relief of asthma.

Substitute—*Datura Tatula* L.—This plant is closely allied to *D. ımonium* L., propagating itself on rich cultivated ground with nearly same facility; but it is not so generally diffused.

De Candolle is of opinion that it is indigenous to the warmer ts of America, whence it was imported into Europe in the 16th

Géographie Botanique, ii. (1855) 731.

Libellus quo demonstratur *Stramonium*, Hyoscyamum, Aconitum . . . esse remedia Vindob. 1762.

century, and naturalized first in Italy, and then in South-Western Europe. By many botanists, it has been united to *D. Stramonium*, but Naudin[1] who has studied both plants with the greatest attention, especially with reference to their hybrids, is decidedly in favour of considering them distinct. *D. Tatula* differs from *D. Stramonium*, in having stem, petiole, and nerves of leaves, *purplish* instead of *green*; and corolla and anthers of a *violet* colour instead of *white*,—characters which, it must be admitted, are of very small botanical value.

D. Tatula has been recommended for smoking in cases of asthma, on the ground of it being *stronger* than *D. Stramonium*; but we are not aware of any authority as to the comparative strength of the two species.

SEMEN STRAMONII.

Stramonium Seeds; F. *Semences de Stramoine*; G. *Stechapfelsamen*.

Botanical Origin—*Datura Stramonium* L., see preceding article.

Description—The spiny, ovoid capsule of stramonium, opens at the summit in four regular valves. It is bilocular, with each cell incompletely divided into two, and contains a large number (about 400) of flattened, kidney-shaped seeds. The seeds are blackish or dark brown, about 2 lines long and ½ a line thick, thinning off towards the hilum which is on the straighter side. The surface of the seed is finely pitted, and also marked with a much coarser series of shallow reticulations or rugosities. A section parallel to the faces of the seed, exhibits the long, contorted embryo, following the outline of the testa, and bedded in the oily white albumen. The cylindrical form of the embryo is seen in a transverse section of the seed.

The seeds have a bitterish taste, and when bruised, a disagreeable odour. When the entire seeds are digested in spirit of wine, they afford a tincture displaying a green fluorescence.

Microscopic Structure—The testa is formed of a row of radially extended, thick-walled cells. They are not of a simply cylindrical form, but their walls are sinuously bent in and out in the direction of their length. Viewed in a direction tangential to the surface, the cells appear as if indented one into the other. Towards the surface of the seed, the cell-walls are elevated as dark brown tubercles and folds, giving to the seed its reticulated and pitted surface. The albumen and embryo exhibit the usual contents, namely fatty oil and albuminoid substances.

Chemical Composition—The active constituent of stramonium seeds, is the highly poisonous alkaloid *Daturine*, of which they afford only about $\frac{1}{10}$ per cent., while the leaves and roots contain it in still smaller proportion.[2] Daturine was discovered in 1833, by Geiger and Hesse, and regarded as identical with atropine by A. von Planta (1850), who found it to have the same composition as that alkaloid. The two bodies exhibit the same relations as to solubility and fusing point (88–90° C.), and they also agree in crystallizing easily. The experiments of Schroff (1852) tending to show that although daturine and atropine act in the

[1] *Comptes Rendus*, lv. (1862) 321.

[2] Günther in Wiggers and Husemann's *Jahresbericht* for 1869. 54.

ne manner, the latter has twice the poisonous energy of the former, ed a further question as to the identity of the two alkaloids. From observations of Erhard (1866), it would appear that the crystalline n of some of their salts is different. In stramonium seeds, daturine pears to be combined with malic acid. The seeds yielded to Cloëz 65) 2·9 per cent. of ash and 25 per cent. of fixed oil.

Uses—Stramonium seeds are prescribed in the form of extract or cture, as a sedative or narcotic.

SEMEN ET FOLIA DATURÆ ALBÆ.

Seeds and Leaves of the Indian or White-flowered Datura.

Botanical Origin—*Datura alba* Nees, a large, spreading annual nt, 2 to 6 feet high, bearing handsome, tubular, white flowers 5 to 6 hes long. The capsules are pendulous, of depressed globular form, her broader than high, covered with sharp tubercles or thick short nes. They do not open by regular valves as in *D. Stramonium*, but it in different directions and break up into irregular fragments.

D. alba appears to be scarcely distinct from *D. fastuosa* L. th are common in India, and are grown in gardens in the south of rope.[1]

History—The mediæval Arabian physicians were familiar with tura *alba*, which is well described by Ibn Baytar[2] under precisely same Arabic name (*Jouz-masal*) that it bears at the present day; y were also fully aware of its poisonous properties.

Garcia d'Orta[3] (1563) observed the plant in India and has narrated t its flowers or seeds are put into food, to intoxicate persons it was igned to rob. It was also described by Christoval Acosta, who in his k on Indian drugs,[4] mentions two other varieties, one of them with low flowers, the seeds of either being very poisonous and often administered with criminal intent, as well as for the cure of disease. ham[5] says of the plant that it possesses very strong narcotic perties, and has on several occasions been fatally used by Bombay ves, who have administered it in order to deprive their victims of power of resistance.

The seeds and fresh leaves have a place in the *Pharmacopœia of* ia, 1868.

Description—The seeds of *D. alba* are very different in appearance n those of *D. Stramonium*, being of a light yellowish brown, rather er size, irregular in shape and somewhat shrivelled. Their form has n likened to the human ear; they are in fact obscurely triangular or tened-pearshaped, the rounded end being thickened into a sinuous,

seeds of *D. alba* sent to us from Madras r. Bidie, were sown by our friend M. in of Collioure (Pyrénées Orientales), produced the plant under three forms, —1. The true *D. alba* as figured in t's *Icones*. — 2. Plants with flowers, t without and nearly white within (*D. fastuosa*).—3. Plants with double corollas of large size and of a yellow colour.

[2] Sontheimer's translation, i. 269.

[3] *Aromatum historia*, 1574, lib. 2. c. 24.

[4] *Tractado de la Drogas . . . de las Indias Orientales*, Burgos, 1578. 85.

[5] *Catalogue of Bombay Plants*, 1839. 141.

convoluted, triple ridge, while the centre of the seed is somewha pressed. The hilum runs from the pointed end, nearly half-way u length of the seed. The testa is marked with minute rugosities, not so distinctly pitted as in the seed of the *D. Stramonium*; it i more developed, exhibiting in section large intercellular spaces to are due its spongy texture. The seeds of the two species agree in in structure as well as in taste; but those of *D. alba* do not give a fluor tincture.

The leaves, which are only employed in a fresh state, are 6 inches in length, with long stalks, ovate, often unequal at the acuminate, coarsely dentate with a few spreading teeth. They evo offensive odour when handled.

Microscopic Structure—The testa is built up of the same tis in *D. Stramonium*, but the thick-walled cells constituting the part are far larger, and distinctly show numerous secondary de making a fine object for the microscope.

Chemical Composition—Neither the seeds nor the leaves *alba* have yet been examined chemically, but there can scarcely doubt that their very active properties are due to *Daturine*, for t paration of which the former would probably be the best source.

Uses—The seeds in the form of tincture or extract have be ployed in India as a sedative and narcotic, and the fresh leaves, and made into a poultice with flour, as an anodyne application.

FOLIA HYOSCYAMI.

Henbane Leaves; F. *Feuilles de Jusquiame*; G. *Bilsenkrau*

Botanical Origin—*Hyoscyamus niger* L., a coarse, erect her soft, viscid, hairy foliage of unpleasant odour, pale yellowish elegantly marked with purple veins, and 5-toothed bottle-shape It is found throughout Europe from Portugal and Greece to Norway and Finland, in Egypt, Asia Minor, the Caucasus. Siberia and Northern India. As a weed of cultivation, it now also in North America[1] and Brazil. In Britain, it occurs wild in waste places near buildings; and is cultivated for medicinal us

Henbane exists under two varieties, known as *annual* and *b* but scarcely presenting any other distinctive character.

Biennial Henbane (*Hyoscyamus niger* var. *α. biennis*) is most es for pharmaceutical preparations. It is raised by seed, the pla ducing the first year, only a rosette of luxuriant stalked leaves more inches in length. In the second, it throws up a flower 2 to 3 feet in height, and the whole plant dies as the fruit matur

Annual Henbane (*H. niger* var. *β annua*, vel *agrestis*) is a plant, coming to perfection in a single season. It is the usual wil but it is also grown by the herbalists.[2]

[1] It had become naturalized in North America prior to 1672, as we find it mentioned by Josselyn in his *New England's Rarities discovered* (Lond. 1672) among the plants "sprung up since the English and kept cattle in New England."

[2] *Pharm. Journ.* i. (1860) 414.

History—Hyoscyamus, under which name it is probable the nearly ed South European species, *H. albus* L., was generally intended, was licinal among the ancients, and particularly commended by Diosdes.

In Europe, henbane has been employed from remote times. Beneus Crispus, archbishop of Milan, in a work written shortly before 681, notices it under the name of *Hyoscyamus* and *Symphoniaca*.[1] the 10th century, its virtues were particularly recorded by Macer idus[2] who called it *Jusquiamus*.

Frequent mention is made of it in the Anglo-Saxon works on medicine he 11th century,[3] in which it is called *Henbell*, and sometimes *Belene*, latter word perhaps traceable in *βιλινουντία*, which Dioscorides[4] s as the Gallic designation of the plant.

The word *Hennebone*, with the Latin and French synonyms *Jusquis* and *Chenille*, occurs in a vocabulary of the 13th century; and *nebane* in a Latin and English vocabulary of the 15th century.[5] In *Arbolayre*, a printed French herbal of the 15th century,[6] we find plant described as *Hanibane* or *Hanebane* with the following explanan—" Elle est aultrement appeler cassilago et aultrement simphoniaca. semence prpprement a nom jusquiame ou hanebane, et herbe a nom ilago. . ." Both *Hyoscyamus* and *Jusquiamus* are from the Greek *κύαμος*, i.e. *Hog-bean*.

Though a remedy undeniably potent, henbane in the first half of the century had fallen into disuse. It was omitted from the London macopœias of 1746 and 1788, and restored only in 1809. Its troduction into medicine was chiefly due to the experiments and mmendations of Störck.[7]

Description—The stems of henbane, whether of the annual or nial form, are clothed with soft, viscid, hairy leaves, of which the r constitute the large, sessile, coarsely-toothed bracts of the unilateral er-spike. The middle leaves are more toothed and subamplexicaul. lower leaves are stalked, ovate-oblong, coarsely dentate, and of large The stems, leaves, and calyces of henbane are thickly beset with , soft, jointed hairs; the last joint of many of these hairs exudes a d substance occasioning the fresh plant to feel clammy to the touch. he cultivated plant, the hairiness diminishes.

After drying, the broad light-coloured midrib becomes very conous, while the rest of the leaf shrinks much and acquires a greyish n hue. The drug derived from the flowering plant as found in nerce, is usually much broken. The fœtid, narcotic odour of the leaves is greatly diminished by drying. The fresh plant has but taste.

Dried henbane is sold under three forms, which are not however rally distinguished by druggists. These are 1. *Annual plant*, foliage green tops. 2. *Biennial plant*, leaves of the first year. 3. *Biennial* , foliage and green tops. The third form is always regarded as the

de Renzi, *Collectio Salernitana*, Na- (1852) 74. 84.

Viribus Herbarum, edited by Chou- ipa. 1832. 108.

rchdoms, &c. of Early England, iii. 313.

[4] Lib. iv. c. 69. (ed. Sprengel).

[5] Wright, *Volume of Vocabularies*, 1857 141. 265.

[6] See p. 130, note 9, also Brunet, *Manue du Libraire*, i. (1860) 377.

[7] See p. 413, note 2.

best, but no attempt has been made to determine with accurac relative merits of the three sorts.

Chemical Composition—*Hyoscyamine*, the most important a the constituents of henbane, was obtained in an impure state by (and Hesse in 1833. Höhn in 1871 first isolated it from the seeds, are far richer in it than the leaves.[1] The seeds are deprived fatty oil (26 per cent.) and treated with spirit of wine containin phuric acid, which takes out the hyoscyamine in the form of sul The alcohol is then evaporated and tannic acid added; the preci thus obtained is mixed with lime and exhausted with alcohol. hyoscyamine is again converted into a sulphate, the aqueous solut which is then precipitated with carbonate of sodium, and the al dissolved by means of ether. After the evaporation of the ether, cyamine remains as an oily liquid which after some time concret wart-like tufted crystals, soluble in benzol, chloroform, ether, a as in water. Höhn and Reichardt assign to hyoscyamine the fo $C^{15}H^{23}NO^3$. The seeds yield of it only 0·05 per cent.

Hyoscyamine is easily decomposed by caustic alkalis. By with baryta in aqueous solution, it is split into *Hyoscine*, C^6H^{11} *Hyoscinic Acid*, $C^9H^{10}O^3$. The former is a volatile alkaloid; hy acid, a crystallizable substance having an odour resembling that pyreumatic benzoic acid.[2]

Attfield [3] has pointed out, that extract of henbane is rich in of potassium and other inorganic salts. In the leaves, the am nitrate is, according to Thorey,[4] largest before flowering, and th observation applies to hyoscyamine.

Uses—Henbane in the form of tincture or extract is admi as a sedative, anodyne or hypnotic. The impropriety of givi conjunction with free potash or soda which render it perfectl has been demonstrated by the experiments of Garrod.[5] Hyosc like atropine, powerfully dilates the pupil of the eye.

Substitutes—*Hyoscyamus albus* L., a more slender plant *niger* L., with stalked leaves and bracts, a native of the Medite region, is sometimes used in the south of Europe as medicinal l *H. insanus* Stocks, a plant of Beluchistan, is mentioned in the *l copœia of India* as of considerable virulence, and sometimes smoking.

FOLIA TABACI.

Herba Nicotianæ; Tobacco; F. *Tabac;* G. *Tabakblätter.*

Botanical Origin—*Nicotiana Tabacum* L.—The common plant is a native of the New World, though not now known i

[1] From the experiments of Schoonbroodt (1868), there is reason to believe that the active principle of henbane can be more easily extracted from the *fresh* than from the *dried* plant.

[2] I have had the opportunity of examining the above substances as prepar said chemists.—F. A. F., July 18

[3] *Pharm. Journ.* iii. (1862) 447.

[4] Wiggers and Husemann, Ja 1869. 56.

[5] *Pharm. Journ.* xvii. (1858) 4 (1859) 174.

ı cultivation is carried on in most temperate and sub-tropical

ry—It is stated by Von Martius[1] that the practice of smoking ıs been widely diffused from time immemorial among the natives America, as well as among the inhabitants of the valley of the ıi as far north as the plant can be cultivated.

paniards became acquainted with tobacco when they landed in 492, and on their return introduced it into Europe for the sake licinal properties. The custom of inhaling the smoke of the learnt from the Indians, and by the end of the 16th century ıe generally known throughout Spain and Portugal, whence it o the rest of Europe, and into Turkey, Egypt, and India, noting that it was opposed by the severest enactments both of and Mahommedan governments. It is commonly believed ractice of smoking tobacco was much promoted in England, as the north of Europe generally, by the example of Sir Walter ıd his companions.

:o was introduced into China, probably by way of Japan or uring the 16th or 17th century, but its use was prohibited by rors both of the Ming and Tsing dynasties. It is now cultinost of the provinces, and is universally employed.[2]

:st tolerably exact description of the tobacco plant is that given lo Fernandez de Oviedo y Valdés, governor of St. Domingo, in *ria general de las Indias*,[3] printed at Seville in 1535. In this plant is said to be smoked through a branched tube of the :he letter Y, which the natives call *Tabaco*.

s not until the middle of this century that growing tobacco in Europe,—first at Lisbon, whence the French ambassador, ıt, sent seeds to France in 1560 as those of a valuable medicinal ich was even then diffused throughout Portugal.[4]

·des[5] writing in 1571, speaks of tobacco as brought to Spain a few ·iously, and valued for its beauty and for its medicinal virtues. ter he gives a long account, noticing also the methods of smoking ing the herb, prevalent among the Indians. He also supplies a ıdcut representing the plant, which he states to have white ·d in the centre.

es Gohory[6] who cultivated the plant in Paris at least as early lescribes its flowers as shaded with red, and enumerates various preparations made from it.

› *Maison Rustique* of Charles Estienne, edition of 1583, the res a "*Discours sur la Nicotiane ou Petum mascle*," in which he the plant the first place among medicinal herbs, on account of ır and almost divine virtues.

zur Ethnographie und Sprachen-icas, zumal Brasiliens, i. (1867)

n *Hong Kong Notes and Queries*, F. P. Smith, *Mal. Med. and China*, 1871. 219.

. 2.

hrésor de la langue Françoyse, 429.

[5] *Segunda parte del libro de las cosas que se traen de nuestras Indias occidentales, que sirven al uso de medicina.* Do se trata del Tabaco . . . , Sevilla, 1571. 3.

[6] *Instruction sur l'herbe Petum ditte en France l'herbe de la Royne ou Medicee* . . . Paris, 1572.

The cultivation of tobacco in England, except on a very small scale in a physic garden, has been prohibited by law [1] since 1660.

Description—Amongst the various species of *Nicotiana* cultivated for the manufacturing of smoking tobacco and snuff, *N. Tabacum* is by far the most frequent, and is almost the only one named in the pharmacopœias as medicinal. Its simple stem, bearing at the summit a panicle of tubular pink flowers, and growing to the height of a man, has oblong lanceolate, simple leaves, with the margin entire. The lower leaves more broadly lanceolate and about 2 feet long by 6 inches wide, and shortly stalked. The stem-leaves are semi-amplexicaul, and decurrent at the base. Cultivation sometimes produces cordate-ovate forms of leaf, with a margin more or less uneven, or nearly revolute.

All the herbaceous parts of the plant are clothed with long soft hairs, made up of broad, ribbon-like, striated cells, the points of which exude a glutinous liquid. Small sessile glands are situated here and there on the surface of the leaf. The lateral veins proceed from the thick midrib in straight lines, at angles of 40° to 75°, gently curving upwards only near the edge. In drying, the leaves become brittle and as thin as paper, and always acquire a brown colour. Even by the most careful treatment of a single leaf, it is not possible to preserve the green hue.

The smell of the fresh plant is narcotic; its taste bitter and nauseous. The characteristic odour of dried tobacco is developed during the process of curing.

Chemical Composition—The active principle of tobacco, first isolated in 1828 by Posselt and Reimann, is a volatile alkaloid termed *Nicotine*, $C^{10}H^{14}N^2$. It is easily extracted from tobacco by means of alcohol or water, as a malate, from which the alkaloid can be separated by shaking it with caustic lye and ether. The ether is then expelled by warming the liquid, which finally has to be mixed with slaked lime and distilled in a stream of hydrogen, when the nicotine begins to come over at about 200° C.

Nicotine is a colourless oily liquid, of sp. gr. 1·027 at 15° C.; it boils at 250° C., and does not concrete even at −10° C. It has a strong alkaline reaction, an unpleasant odour, and a burning taste. It quickly assumes a brown colour on exposure to air and light; and appears even to undergo an alteration by repeated distillation in an atmosphere deprived of oxygen. Nicotine dissolves in water, but separates on addition of caustic potash. Most salts of nicotine crystallize with difficulty; its hydrochlorate forms with chloride of zinc a compound obtainable in crystals of considerable size. Nicotine is the highly poisonous principle of tobacco; it occurs in the dried leaves to the extent of about 6 per cent., but is subject to great variation. It has been met with in tobacco-smoke by Vohl and Eulenberg (1871), though other chemists assert its occurrence. The vapours were found by the former, to contain numerous basic substances of the picolinic series, and ceded to caustic potash, hydrocyanic acid, sulphuretted hydrogen, several volatile fatty acids, phenol and creasote. There was further observed

[1] 12 Car. II. c. 34; 15 Car. II. c. 7.—For further information on the history of tobacco, see Tiedemann, *Geschichte des Tabaks*, Frankfurt, 1854.

imperfect combustion of tobacco, the formation of laminæ fusible at C. and having the composition $C^{19}H^{18}$.

Tobacco leaves, whether fresh or dried, yield when distilled with er, a turbid distillate in which, as observed by Hermbstadt in 1823, re are formed after some days, crystals of *Nicotianin* or *Tobacco Cam-r*. According to J. A. Barral, nicotianin contains 7·12 per cent. of nitro- (?). By submitting 4 kilogrammes of good tobacco of the previous year listillation with much water, we obtained nicotianin, floating on the ace of the distillate, in the form of minute acicular crystals, which found to be devoid of action on polarized light. The crystals have peculiar taste, at least in the small quantity we tried; they have a cco-like smell, perhaps simply due to the water adhering to them. en an attempt was made to separate them by a filter, they entirely ppeared, being probably dissolved by an accompanying trace of ntial oil. The clear water showed an alkaline reaction partly due to *tine;* this was proved by adding a solution of tannic acid, which ed a well-marked turbidity.

Among the ordinary constituents of leaves, tobacco contains albumin, n and gum. In smoking, these substances as well as the cellulose of thick midrib, would yield products not agreeable to the consumer. e manufacturer therefore discards the midrib, and endeavours by her preparation to ensure at least the partial destruction of these elcome constituents, as well as the formation of certain products of entation (ferment-oils), which may perhaps contribute to the aroma tobacco, especially when saccharine substances, liquorice, or alcohol. added in the maceration to which tobacco is subjected.

Tobacco leaves are remarkably rich in inorganic constituents, the pro-ion varying from 16 to 27 per cent. According to Boussingault, they ain when dry about 1 per cent. of phosphoric acid, and from 3 to 5 cent. of potash, together with 2½ to 4½ per cent. of nitrogen partly in form of nitrate, so that to enable the tobacco plant to flourish, it t have a rich soil or continual manuring.

The lime amounting to between a quarter and a half of the entire tity of ash, is in the leaf combined with organic acids, especially malic, ps also citric. The proportion of potash varies greatly, but may nt to about 30 per cent. of the ash.

Commerce—There were imported into the United Kingdom in the 1872, 45,549,700 lb. of Unmanufactured Tobacco, rather more than of which was derived from the United States of America. The value of the commodity thus imported was £1,563,882; and the levied upon the quantity retained for home consumption, amounted ,694,037.

Uses — Tobacco has some reputation in the removal of alvine ctions, but it is a medicine of great potency and is very y used.

Substitutes—Of the other species of *Nicotiana* cultivated as *Tobacco*, *stica* L. is probably the most extensively grown. It is easily guished by its greenish yellow flowers, and its stalked ovate . In spite of their coarser texture, the leaves dry more easily than of *N. Tabacum*, and with some care may even be made to retain

their green colour. *N. rustica* furnishes *East Indian Tobacco*, also the kinds known as *Latakia* and *Turkish Tobacco*.

N. Persica Lindl. yields the tobacco of Shiraz. *N. quadrivalvis* Pursh, *N. multivalvis* Lindl. and *N. repanda* Willd. are also cultivated plants, the last named, a plant of Havana, being used in the manufacture of a much valued kind of cigar.

SCROPHULARIACEÆ.

FOLIA DIGITALIS.

Foxglove Leaves; F. *Feuilles de Digitale*; G. *Fingerhutblätter*.

Botanical Origin—*Digitalis purpurea* L., an elegant and stately plant, common throughout the greater part of Europe, but preferring siliceous soils and generally absent from limestone districts. It is found on the edges of woods and thickets, on bushy ground and commons, becoming a mountain plant in the warm parts of Europe. It occurs in Central and Southern Spain, Northern Italy, France, Germany, the British Isles and Southern Sweden, and in Norway as far as 62° N. lat.; it is however very unequally distributed, and is altogether wanting in the Swiss Alps and the Jura.[1] As a garden plant it is well known.

History—We are acquainted with no very ancient accounts of the use of foxglove in medicine. Fuchs[2] and Tragus[3] about the middle of the 16th century figured the plant; the former gave it the name *Digitalis*, remarking that up to the time at which he wrote, there was none for the plant in either Greek or Latin. At that period it was regarded as a violent medicine. It had a place in the London Pharmacopœia of 16[illegible] and in several subsequent editions. The investigation of its therapeutic powers (1776–9) and its introduction into modern practice are chiefly due to Withering, a well-known English botanist and physician.[4]

The word *foxglove* is said to be derived from the Anglo-Saxon *Foxglew*, i.e. *fox-music*, in allusion to an ancient musical instrument consisting of bells hung on an arched support.[5]

Description—Foxglove is a biennial or perennial, the leaves of which ought to be taken from the plant while in full flower. The lower leaves are ovate with the lamina running down into a long stalk; those of the stem become gradually narrower, passing into ovate-lanceolate with a short broadly-winged stalk, or are sessile. All have the margin crenate, crenate-dentate, or sub-serrate, are more or less softly pubescent or nearly glabrous on the upper side, much paler and densely pubescent on the under, which is marked with a prominent network of veins. The principal veins diverge at a very acute angle from the midrib, which is thick and fleshy. The lower leaves are often a foot or more long, by 5 to [illegible] inches broad; those of the stem are smaller.

[1] Dr. R. O. Cunningham found (1868) *Digitalis purpurea* completely naturalized about San Carlos in the Island of Chiloe in Southern Chili.

[2] *De Hist. Stirpium*, 1542. 892.

[3] *De Stirpium . . . nomenclaturis*, [illegible] 1552—"*Campanula sylvestris seu Ingrata*[illegible]

[4] Withering (William), *Account of the Foxglove*, Birmingham, 1785. 8°.

[5] Prior, *Popular Names of British Plants*, ed. 2. 1870. 84.

ı magnified, the tip of each crenature or serrature of the leaf, is be provided with a small, shining, wart-like gland. The hairs 'er surface are simple, and composed of jointed cells which flatten ; those of the upper surface are shorter.

eparing foxglove for medicinal use, it is the custom of some to remove the whole of the petiole and the thicker part of the etaining only the thin lamina, which is dried with a gentle heat.[1] leaf has when bruised an unpleasant herbaceous smell, which becomes agreeable and tea-like. The dried leaf has a very te.

ıical Composition—Since the beginning of the present cen- ıerous attempts have been made to prepare the active principle 'e, and the name *Digitalin* has been successively bestowed on fferent substances.

g the investigators engaged in these researches, we may espe- nt out Walz (1846–1858), Kosmann (1845–46, 1860), Homolle th Quévenne (1845–61), and O. A. Nativelle (1872).

Digitalin of Walz, first called *Digitasolin*, has the formula . It is amorphous, sparingly soluble in cold, more readily in , and easily dissolved by alcohol. By dilute acids it is resolved , *Digitaliretin* and *Paradigitaletin*, the last two amorphous.

igitalin of Kosmann is described as being in crystalline scales, soluble in water, freely in alcohol, not in ether.

igitalin of Homolle (*Digitaline of Homolle and Quévenne*) which opted in the *British Pharmacopœia*, as well as in the French described by Gmelin as a colourless substance in "warty fine scales" ("porous mammillated masses or small scales" *harm.*)—inodorous, extremely bitter, dissolving easily in spirit ery slightly soluble in water or ether; soluble in acids, but not vith them neutral compounds. Its solution in hydrochloric st pale yellow, rapidly becomes green. This substance is not ded by chemists as of perfectly definite composition.

Digitalin of Nativelle—The researches on digitalis of this for which the Orfila prize of 6000 francs was awarded in 'e resulted in the extraction of a crystallized digitalin, active medicinal properties. It may be obtained by the process:—

aves previously exhausted by water, are extracted by means sp. gr. ·930. The tincture is concentrated until its weight is hat of the leaves used, and then diluted by adding thrice its water. A pitch-like deposit is then formed; *digitaléin* and tances remaining in solution. The deposit dried on blotting oiled with double its weight of alcohol, sp. gr. ·907; on cooling, e slowly deposited during some days. They should be washed le diluted alcohol (·958) and dried: to purify them, they should ecrystallized from chloroform, and subsequently from boiling . gr. ·828, some charcoal being used at the same time. Digi- us obtained in *colourless needle-shaped crystals*. It assumes an

hod of preparing the leaf was the London Pharmacopœia of had long been in use. No particular directions are given in the British Pharmacopœia.

intense emerald green colour when moistened with hydrochloric acid, and has an extremely bitter taste. On the animal economy, it displays all the peculiar effects of digitalis, the dose of a milligramme taken by an adult person once or twice a day occasioning somewhat alarming symptoms, but smaller doses exhibiting the sedative power of the herb.

Lastly, we may mention a *Digitalin* prepared from the *seeds of Digitalis* by Prof. Delffs of Heidelberg, to whom we are indebted for a specimen. It is a neutral, colourless, crystalline substance, readily soluble in alcohol, ether, or chloroform; not coloured by concentrated mineral acids, or by bromine. Prof. Delffs finds it to be a glucoside, having the composition $C^{17}H^{30}O^{7}$.

What relation these substances bearing the name of *Digitalin* have to one another, is a question that must be left for further investigation. Another body occurring in foxglove is the crystallizable sugar called *Inosite*, which was detected by Marmé in the leaves, as well as in those of dandelion (p. 353).

Uses—Foxglove is a very potent drug, having the effect of reducing the frequency and force of the heart's action, and hence is given in special cases as a sedative; it is also employed as a diuretic.

Adulteration—The dried leaves of some other plants have occasionally been supplied for those of foxglove. Such are the leaves of *Verbascum*, which are easily recognized by their thick coat of branched stellate hairs; of *Inula Conyza* DC. and *I. Helenium* L., which have the margin almost entire, and in the latter plant, the veins diverging nearly at a right angle from the midrib; in both plants the under side of the leaf is less strongly reticulated than in foxglove. But to avoid all chance of mistake, it is desirable that druggists should purchase the *fresh flowering plant*, which cannot be confounded with any other, and strip and dry the leaves for themselves.

ACANTHACEÆ.

HERBA ANDROGRAPHIDIS.

Kariyát or Creyat.

Botanical Origin—*Andrographis*[1] *paniculata* Nees ab E. (*Justicia* Burm.), an annual herb, 1 to 2 feet high, common throughout India, growing under the shade of trees. It is found likewise in Ceylon and Java, and has been introduced into the West Indies. In some districts of India it is cultivated.

History—It is probable that in ancient Hindu medicine, this plant was administered indiscriminately with chiretta, which with several other species of *Ophelia*, is known in India by nearly the same vernacular names. Ainslie asserts that it was a component of a famous bitter tincture called by the Portuguese of India *Droga amara*; but on consulting the authority he quotes[2] we find that the bitter employed in that medicine was *calumba*. *Andrographis* is known in Bengal as

[1] *Andrographis* from ἀνήρ and γραφίς, in allusion to the brush-like anther and filament.

[2] Paolino da San Bartolomeo, *Voyage to the East Indies* (1776–1789), translated from the German, Lond. 1800. pp. 14. 4:9.

ita, literally *king of bitters*, a title of which it has been thought so rving, that it has been admitted to a place in the *Pharmacopœia a*.

scription—The straight, knotty, branched stems are obtusely igular, about ¼ of an inch thick at the base, of a dark green and longitudinally furrowed. The leaves are opposite, petiolate, ate, entire, the largest ½ an inch or more wide and 3 inches long. pper surface is dark green, the under somewhat lighter, and as der a lens finely granular. The leaves are very thin, brittle, and stems, entirely glabrous.

he well-dried specimen before us, for which we are indebted to Bidie of Madras, flowers are wanting and only a few roots are . The latter are tapering and simple, emitting numerous thin , greyish externally, woody and whitish within. The plant is us and has a persistent pure bitter taste.

emical Composition—The aqueous infusion of the herb exhibits acid reaction, and has an intensely bitter taste, which appears an indifferent, non-basic principle, for the usual reagents do not the presence of an alkaloid. Tannic acid on the other hand s an abundant precipitate, a compound of itself with the bitter le. The infusion is but little altered by the salts of iron; it s a considerable quantity of chloride of sodium.

es—Employed as a pure bitter tonic like quassia, gentian, or , with the last of which it is sometimes confounded.

SESAMEÆ.

OLEUM SESAMI.

Oil, Gingeli, Gingili or Jinjili Oil, Til or Teel Oil, Benné Oil; F. *Huile de Sésame;* G. *Sesamöl.*

anical Origin—*Sesamum indicum* DC., an erect, pubescent, herb, 2 to 4 feet high, indigenous to India, but propagated by ion throughout the warmer regions of the globe. In Europe, *m* is only grown in some districts of Turkey and Greece, and on scale in Sicily and in the islands of Malta and Gozo. It does ceed well even in the South of France.

tory—Sesamé is a plant which we find on the authority of the ncient documents of Sanskrit, Greek, and Roman literature, has sed by mankind for the sake of its oily seeds from the earliest In the days of Pliny, the oil was an export from Sind to Europe of the Red Sea, precisely as the seeds are at the present day.

ring the middle ages the plant, then known as *Suseman* or s, was cultivated in Cyprus, Egypt and Sicily. In later times, oil gave way to that of olives, yet at present it is an article if not so renowned, is at least of far greater consumption.

word *Sesamé* is derived from *Simsim*, the Arabic name of the

plant. The Indian languages have their own terms for it, the Hi stani *Til*, from the Sanskrit *Tilaha*, being one of the best known.[1]

Production—The plant comes to perfection within 3 or 4 mo its capsule contains numerous flat seeds, which are about $\frac{3}{10}$ of an long by $\frac{1}{20}$ thick, and weigh on an average $\frac{1}{16}$ of a grain. To c them, the plant when mature is cut down, and stacked in heaps few days, after which it is exposed to the sun during the da collected again into heaps at night. By this process the ca gradually ripen and burst, and the seeds fall out.[2]

The plant is found in several varieties affording respectively yellowish, reddish, brown or black seeds. The dark seeds may be de of a part of their colouring matter by washing, which is sometime with a view to obtain a paler oil.[3]

We obtained from yellowish seeds, 56 per cent. of oil; on a scale, the yield varies with the variety of seed employed and the p of pressing, from 45 to 50 per cent.

Description—The best kinds of sesamé oil have a mild agr taste, a light yellowish colour, and scarcely any odour; but in respects the oil is liable to vary with the circumstances already tioned. The white seeds produced in Sind are reputed to yie finest oil.

We prepared[4] some oil by means of ether, and found it to l sp. gr. of 0·919 at 23° C.; it solidified at 5° C., becoming rather at some degrees above this temperature. Yet sesamé oil is mor at ordinary temperatures than ground-nut oil, and is less pr change by the influence of the air. It is in fact when of fine q one of the less alterable oils.

Chemical Composition—The oil is a mixture of olein, stea other compounds of glycerin with acids of the fatty series. W pared with it in the usual way a lead plaster, and treated the latt ether in order to remove the oleate of lead. The solution wa decomposed by sulphuretted hydrogen, evaporated, and exposed t nitric vapours. By this process we obtained 72·6 per cent. of *Acid*. The specimen of sesamé oil prepared by ourselves, conse contained 76·0 per cent. of olein, inasmuch as it must be suppose present in the form of triolein. In commercial oils, the am olein is certainly not constant.

As to the solid part of the oil, we succeeded in removing fatt freely melting after repeated crystallizations, at 67° C., which may of stearic acid mixed with one or more of the allied homologou as palmitic and myristic. By precipitating with acetate of mag

[1] We know not the origin of the word *Gingeli*, which Roxburgh remarks was (as it is now) in common use among Europeans. No such name occurs in the copious lists collected by Moodeen Sheriff and published in the *Supplement to the Pharm. of India*. The word *Benné* is, we believe, of West African origin, and has no connexion with *Ben*, the name of *Moringa*.

[2] For further particulars, see Buchanan, *Journey from Madras through Mysore, &c.* i. (1807) 95. and ii. 224.

[3] This curious process is describ *Reports of Juries, Madras Exhibit* p. 31.—That the colouring matt seeds is actually soluble in water is by Lépine of Poudicherry as we h from his manuscript notes present Musée des Produits des Colonies at Paris. The seeds may even be a dye.

[4] The experiments narrated in t were performed by Dr. F.

sed by Heintz, we finally isolated acids melting at 52·5 to ! to 63° C., and 69·2° C., which correspond to myristic, palmitic ic acids.

mall proportion of solid matter which separates from the oil on ɔn, cannot be removed by pressure, for even at many degrees : freezing point, it remains as a soft magma. In this respect, l differs from that of olive.

ıé oil contains an extremely small quantity of a substance, esinoid, which has not yet been isolated. It may be obtained ɔn by repeatedly shaking 5 volumes of the oil with one of etic acid. If a cold mixture of equal weights of sulphuric : acids is added in like volume, the acetic solution acquires a yellow hue. The same experiment being made with spirit of stituted for acetic acid, the mixture assumes a blue colour, hanging to greenish yellow. The oil itself being gently shaken ɔhuric and nitric acids, takes a fine green hue, as shown in Behrens, who at the same time pointed out that no other oil this reaction. It takes place even with the bleached and per-lourless oil. Sesamé oil added to other oils, if to a larger an 10 per cent., may be recognized by this test. The reaction be observed with small quantities, say 1 gramme of the oil and e of the acid mixture, previously cooled.

merce—The commercial importance of Sesamé may be at once d by the fact that France imported in 1870, 83 millions; in ½ millions; and 1872, 50 millions of kilogrammes (984,693 he seed.[1]

quantity shipped from British India in the year 1871–72 was cwt., of which France took no less than 495,414 cwt.[2] The f the seed into the United Kingdom in 1870, were to the value bout £13,000.

ıé is extensively produced in the Chinese island of Formosa, 1869, exported the exceptionally large quantity of 46,000 1 pecul = 133 ℔.) Zanzibar also furnishes considerable quanti-esamé, whilst on the West Coast of Africa, the staple oil-seed d-nut (*Arachis hypogœa* L.) The chief place for the manufac-esamé oil is Marseilles.

—Good sesamé oil might be employed without disadvantage he purposes for which olive oil is used.[4] As its congealing some degrees below that of olive oil, it is even more fitted for ates. Sesamé seeds are largely consumed as food both in India ical Africa. The foliage of the plant abounds in mucilage, and nited States is sometimes used in the form of poultice.

nts Statistiques réunis par l'Ad-s des Douanes sur le commerce de nnée 1872.

nt of the Trade and Navigation India with Foreign Countries, 172–62.

[3] *Reports on Trade at the Treaty Ports in China for* 1870, Shanghai, 1871. 81.

[4] For pharmaceutical uses, the larger proportion of olein and consequent lesser tendency to solidify, should be remembered.

LABIATÆ.

FLORES LAVANDULÆ.

Lavender Flowers; F. *Fleurs de Lavande*; G. *Lavendelblumen*.

Botanical Origin—*Lavandula vera* DC., a shrubby plant grow in the wild state from 1 to 2 feet high, but attaining 3 feet or m under cultivation. It is indigenous to the mountainous regions of countries bordering the western half of the Mediterranean basin. T it occurs in Eastern Spain, Southern France (extending northward Lyons and Dauphiny), in Upper Italy, Corsica, Calabria and North Africa,—on the outside of the olive region.[1] In cultivation, it gr very well in the open air throughout the greater part of Germany an far north as Norway and Livonia.

History—There has been much learned investigation in orde identify lavender in the writings of the classical authors, but the re has not been satisfactory, and no allusion has been found w unquestionably refers either to *L. vera* or to *L. Spica*.[2]

The earliest mention of lavender that we have observed, occurs in writings of the abbess Hildegard,[3] who lived near Bingen on the R during the 12th century, and who in a chapter *De Lavendula* allud the strong odour and many virtues of the plant. In a poem of school of Salerno entitled *Flos Medicinæ*[4] occur the following lines

> "Salvia, castoreum, *lavendula*, primula veris,
> Nasturtium, athanas hæc sanant paralytica membra."

Lavender was well known to the botanists of the 16th century.

Description—The flowers of Common Lavender are produced lax terminal spike, supported on a long naked stalk. They are arra in 6 to 10 whorls (verticillasters), the lowest being generally far re from those above it. A whorl consists of two cymes, each having v fully developed, about three flowers, below which is a rhomb acuminate bract, as well as several narrow smaller bracts belongi the particular flowers. The calyx is tubular, contracted towards mouth, marked with 13 nerves and 5-toothed, the posterior tooth r larger than the others. The corolla of a violet colour is tubular, lipped, the upper lip with two, the lower with three lobes. Both co and calyx as well as the leaves and stalks, are clothed with a d tomentum of stellate hairs, amongst which minute shining oil-gl can be seen by the aid of a lens.

The flowers emit when rubbed a delightful fragrance, and ha pleasant aromatic taste. The leaves of the plant are oblong linea lanceolate, revolute at the margin and very hoary when young.

For pharmaceutical use or as a perfume, lavender flowers are stri from the stalks and dried by a gentle heat. They are but sel

1 On Mont Ventoux near Avignon, the region of *Lavandula vera* is comprised according to Martins, between 1500 and 4500 feet above the sea-level.—*Ann. des Sc. Nat.*, Bot. x. (1838) 145. 149.

2 F. de Gingins-Lassaraz, *Hist. des Lavandes*, Genève et Paris, 1826.—*Lavandula Stœchas* L. is however distinctly refer both by Dioscorides and Pliny.

3 *Opera Omnia*, accurante J. P. M Paris, 1855. 1143.

4 S. de Renzi, *Collectio Salernitana* poli, i. 417-516.

it in the shops, being grown almost entirely for the sake of their ential oil.

Production of Essential Oil—Lavender is cultivated in the ishes of Mitcham, Carshalton and Beddington and a few adjoining alities, all in Surrey, to the extent of about 300 acres. It is also wn at Market Deeping in Lincolnshire, and at Hitchin in Hertford-re, at which latter place there were in 1871 about 50 acres so cropped. The plants which are of small size, and grown in rows in dry n fields, flower in July and August. The flowers are usually cut h the stalks of full length, tied up in mats, and carried to the tillery there to await distillation. This is performed in the same large ls that are used for peppermint. The flowers are commonly distilled h the stalks as gathered, and either fresh, or in a more or less dry state. few cultivators distil only the flowering heads, thereby obtaining a erior product. Still more rarely, the flowers are stripped from the lks, and the latter rejected *in toto*. According to the careful experi-nts of Bell,[1] the oil made in this last method is of exceedingly fine lity. The produce he obtained in 1846, was 26½ ounces per 100 ℔. of rers, entirely freed from stalks; in 1847, 25½ ounces; and in 1848, 20 ces: the quantities of flowers used in the respective years were 417, , and 923 ℔. Oil distilled from the stalks alone, was found to have a uliarly rank odour. In the distillation of lavender, it is said that oil which comes over in the earlier part of the operation is of erior flavour.

We have no accurate data as to the produce of oil obtained in the inary way, but it is universally stated to vary extremely with the son. Warren[2] gives it as 10 to 12 ℔., and in an exceptional case as ch as 24 ℔. from the acre of ground under cultivation. At Hitchin,[3] yield would appear to approximate to the last-named quantity. The eriments performed in Bell's laboratory as detailed above, show that flowers deprived of stalks afforded on an average exactly 1½ per cent. essential oil.

Oil of *Lavandula vera* is distilled in Piedmont, and in the ntainous parts of the South of France, as in the villages about nt Ventoux near Avignon, and in those some leagues west of ntpellier (St. Guilhen-le-désert, Montarnaud and St. Jean de Fos),—all cases from the wild plant. This foreign oil is offered in com-ce of several qualities, the highest of which commands scarcely -sixth the price of the oil produced at Mitcham.[4] The cheaper sorts east are obtained by distilling the *entire plant*.

Chemical Composition—The only constituent of lavender flowers t has attracted the attention of chemists, is the essential oil (*Oleum andulæ*). It is a pale yellow, mobile liquid, varying in sp. gr. from 7 to 0·94 (Zeller), having a very agreeable odour of the flowers and a ng aromatic taste. The oil distilled at Mitcham (1871) we find to te the plane of polarization 4·2° to the left, in a column of 50mm. Oil of lavender is a mixture in variable proportions of a hydro-

[1] *Pharm. Journ.* viii. (1849) 276.
[2] *Ibid.* vi. (1865) 257.
[3] *Ibid.* i. (1860) 278. The statement is that an acre of land yields "*about 6 Winchester quarts*" of oil.
[4] The Mitcham oil fetches 30s. to 60s. per ℔., according to the season.

carbon, $C^{10}H^{16}$, and stearoptene, the first of which boils at 200°-21 The stearoptene is identical according to Dumas, with common cam In some samples it is said to exist to the extent of one-half. sometimes deposited from the oil in cold weather; we have not hov been able to ascertain this fact.

Commerce—Dried lavender flowers are the object of some in the south of Europe. According to the official *Tableau génér Commerce de la France*, Lavender and Orange Flowers (which ar separated) were exported in 1870 to the extent of 110,958 (244,741 lb.),—chiefly to the Barbary States, Turkey and Am There are no data to show the amount of oil of lavender imported England.

Uses—Lavender flowers are not prescribed in modern En medicine. The volatile oil has the stimulant properties comm bodies of the same class and is much used as a perfume.

Other Species of Lavender.

1. *Lavandula Spica* DC. is a plant having a very close resemb to *L. vera*, of which Linnæus considered it a variety, though its tinctness is now admitted. It occurs over much of the area of *L.* but does not extend so far north, nor is it found in such elevated s tions, or beyond the limit of the olive. It is in fact a more sou plant and more susceptible to cold, so that it cannot be cultivated i open soil in Britain except in sheltered positions. In Languedo Provence, it is the common species from the sea-level up to about feet, where it is met by the more hardy *L. vera*.[1]

Lavandula Spica is distilled in the south of France, the flow wild plant in its entire state being used. The essential oil whi termed in French *Essence d'Aspic*, is known to English druggis *Oleum Lavandulæ spicæ*, *Oleum Spicæ*, or *Oil of Spike*. It resembles oil of lavender, but compared with that distilled in England, it l much less delicate fragrance.[2] In chemical composition, it agrees oil of *Lavandula vera*. Oil of Spike is used in porcelain painting a veterinary medicine.

2. *Lavandula Stœchas* L.—This plant was well known to ancients; Dioscorides remarks that it gives a name to the Stœch the modern isles of Hières near Toulon, where the plant still abo It has a wider range than the two species of *Lavandula* already desc for it is found in the Canaries and in Portugal, and eastward throu the Mediterranean region to Greece and Asia Minor. It may at on known from the other lavenders by its flower-spike being on a stalk, and terminating in 2 or 3 conspicuous purple bracts.

The flowers, called *Flores Stœchados* or *Stœchas Arabica*,[3] were for kept in the shops, and had a place in the London Pharmacopœia

[1] On the high land between Nice and Turbia, I have observed the two species growing together, and that *L. vera* is in flower two or three weeks earlier than *L. Spica*.—D. H.

[2] Yet we find that flowers of the two plants (*L. vera* and *L. Spica*) grown si side in an English garden, are hardl tinguishable in fragrance.

[3] The incorrectness of the term *A* is noticed by Pomet. How it came applied we know not.

5. We are not aware that they are, or ever were, distilled for
l oil, though they are stated to be the source of *True Oil*
e.[1]

HERBA MENTHÆ VIRIDIS.

Spearmint.

tanical Origin—*Mentha viridis* L. is a fragrant perennial plant,
known in Europe, Asia and North America, as the Common
f gardens, and only found apparently wild in countries where it
ıg been cultivated. It occurs occasionally in Britain under such
stances.[2]

ıtha viridis is regarded by Bentham as not improbably a variety
ilvestris L., perpetuated through its ready propagation by suckers.
laker remarks, that while these two plants are sufficiently distinct
d in England, yet continental forms occur which bridge over their
ıces.[3]

story—Mint is mentioned in all early mediæval lists of plants,
ıs certainly cultivated in the convent gardens of the 9th century.
, who has been called "the father of English botany," states in
rball that the garden mint of his time was also called "*Spere*
" We find spearmint also described by Gerarde who terms it
ı *Romana* vel *Sarracenica*, or *Common Garden Mint*, but his state-
hat the leaves are *white, soft*, and *hairy* does not well apply to the
ıs now found in cultivation.

scription—Spearmint has a perennial root-stock which throws
ıg runners. Its stem 2 to 3 feet high is erect, when luxuriant
ed below with short erecto-patent branches, firm, quadrangular,
or slightly hairy beneath the nodes, often brightly tinged with
Leaves sessile or the lower slightly stalked, lanceolate or ovate-
ate, rounded or even cordate at the base, dark green and glabrous
paler and prominently veined with green or purple beneath, rather
' glandular, but either quite naked or hairy only on the midrib
incipal veins, the point narrowed out and acute, the teeth sharp
either very close nor deep, the lowest leaves measuring about 1
cross by 3 or 4 inches long. Inflorescence a panicled arrange-
f spikes, of which the main one is 3 or 4 inches long by $\frac{3}{8}$ inch
he lowest whorls sometimes $\frac{1}{2}$ an inch from each other and the
bracts leafy. Bracteoles linear-subulate, equalling or exceeding
panded flowers, smooth or slightly ciliated. Pedicels about $\frac{3}{4}$ line
urplish glandular, but never hairy. Calyx also often purplish,
be campanulato-cylindrical, $\frac{3}{8}$ line long, the teeth lanceolate-
te, equalling the tube, the flower part of which is naked, but the
nd often the upper part clothed more or less densely with erecto-
hairs. Corolla reddish-purple, about twice as long as the calyx,
both within and without. Nut smooth.

ira, *Elem. of Mat. Med.* ii. (1850)
for do we know if *L. lanata* Boiss.
fragrant species closely allied to *L.*
., and a native of Spain, is distilled
ountry.

ham, *Handbook of the British Flora*,
13.—Parkinson (1640) remarks of *Spearc Mint* that it is "onely found planted in gardens with us."

[2] Seemann's *Journ. of Bot.* Aug. 1865. p. 239. We borrow Mr. Baker's careful description of *M. viridis*.

[4] Part 2. (1568) 54.

The plant varies slightly in the shape of its leaves, elongati spike and hairiness of calyx. The entire plant emits a most fra odour when rubbed, and has a pungent aromatic taste.

Production—Spearmint is grown in kitchen gardens, and largely in market gardens. A few acres are under cultivation wi at Mitcham, chiefly for the sake of the herb, which is sold mostly dried state.

The cultivation of spearmint is carried on in the United Stat precisely the same manner as that of peppermint, but on a much sa scale. Mr. H. G. Hotchkiss of Lyons, Wayne County, State of York, has informed us that his manufacture of the essential oil amo in 1870 to 1162 lb. The plant he employs appears from the spe with which he has favoured us, to be identical with the spearm English gardens, and is not the Curled Mint (*Mentha cris* Germany.

Chemical Composition—Spearmint yields an essential oil (*Menthæ viridis*) in which reside the medicinal virtues of the Kane[1] who examined it, gives its sp. gr. as 0·914, and its boiling as 160° C. The oil yielded him a considerable amount of stear Gladstone[2] found spearmint oil to contain a hydrocarbon identical with oil of turpentine in odour and other physical pro mixed with an oxidized oil to which is due the peculiar smell plant. The latter oil boils at 225° C.; its sp. gr. is 0·951, and found to be isomeric with carvol, $C^{10}H^{14}O$.

Uses—Spearmint is used in the form of essential oil and d water, precisely in the same manner as peppermint. In the States, the oil is also employed by confectioners and the manufa of perfumed soap.

Substitutes—Oil of spearmint is now rarely distilled in E its high cost[3] causing it to be nearly unsaleable. The cheaper oil is offered in price-currents as of two kinds, namely *Americ German.* Of the first we have already spoken: the second ter German *Krausemünzöl*, is the produce of *Mentha aquatica* L. var. Bentham, a plant cultivated in Northern Germany.

HERBA MENTHÆ PIPERITÆ.

Peppermint; F. *Menthe poivrée*; G. *Pfefferminze.*

Botanical Origin—*Mentha piperita* Hudson (non Linn.), ar usually glabrous perennial, much resembling the Common Spear the gardens, but differing from it in having the leaves all stalk flowers larger, the upper whorls of flowers somewhat crowded to and the lower separate. In the opinion of Bentham it is possibly variety of *M. hirsuta* L., with which it can be connected by nu intermediate forms.

Peppermint rapidly propagates itself by runners, and is now in wet places in several parts of England, as well as on the Con

[1] *Philosophical Magazin*, xiii. (1838) 444.
[2] *Journ. of Chemical Society*, ii. (1864) 11.
[3] Price from 1824 to 1832, 4s per lb.

ıltivated on the large scale in England, France, Germany, and ımerica.

tory—*Mentha piperita* was first observed in Hertfordshire by ɜs and communicated to Ray, who in the second edition of his ı *Stirpium Britannicarum*, 1696, noticed it under the name of *spicis brevioribus et habitioribus, foliis Menthæ fuscæ, sapore fervido* and in his *Historia Plantarum*[1] as "*Mentha palustris* . . . *int.*"[2] Dale who found the plant in the adjoining county of tates[3] that it is esteemed a specific in renal and vesical calculus; ɾ in the third edition of his *Synopsis*, declares it superior to all ints as a remedy for weakness of the stomach and for diarrhœa. nint was admitted to the London Pharmacopœia in 1721, under gnation of *Mentha piperitis sapore.*

cultivation of peppermint at Mitcham in Surrey, dates from about t which period only a few acres of ground were there devoted to al plants. At the end of the last century, above 100 acres were with peppermint. But so late as 1805 there were no stills at n, and the herb had to be carried to London for the extraction of Of late years the cultivation has diminished in extent, by reason ncreased value of land and the competition of foreign oil of ıint.

Germany, peppermint became practically known in the latter the last century, especially through the recommendation of

cription—The rootstock of peppermint is perennial, throwing ıers. The stem is erect, 3 to 4 feet high, when luxuriant some-anched below with erecto-patent branches, firm, quadrangular, hairy, often tinged with purple. Leaves all stalked, the stalks of r ½ to ¾ of an inch long, naked or nearly so, the leaf lanceolate, d or rather rounded towards the base, the point narrowed out and ıe lowest 2 to 3 inches long by about ¾ of an inch broad, naked green above, paler and glandular all over, but only slightly hairy ɜ veins beneath; the teeth sharp, fine, and erecto-patent. Inflo-in a loose lanceolate or acutely conical spike, 2 to 3 inches long by ɔf an inch broad at the base, the lowest whorls separate, and usually est bracts leaf-like. Bracteoles lanceolate acuminate, about g the expanded flowers, slightly ciliated. Pedicels 1 to 1½ lines rplish, glandular but not hairy. Calyx often purplish, the tube line long and the teeth ½ a line, the tube campanulate-cylindrical, , not hairy, but dotted over with prominent glands; the teeth te subulate, furnished with short erecto-patent hairs. Corolla purple about twice as long as the calyx, naked both within and Nut smooth[6] (*rugose*, according to our observation). The odour ɜ are strongly aromatic.

ı iii. (1704) 284.

examined the original specimen rved among Ray's plants in the useum and find it to agree per-ı the plant now in cultivation.—

ıacologiæ *Supplementum*, Lond.

[4] Lysons, *Environs of London*, i. (1800) 254.

[5] *De Menthâ Piperitide Commentatio*, Erlangæ, 1780.

[6] This description is borrowed from Mr. Baker's paper on the English Mints, referred to at p. 431, note 3.

In var. 2. *vulgaris* of Sole, *M. piperita* β. Smith, the plant is ı hairy, with the spikes broader and shorter, or even bluntly capitate.

Chemical Composition—The constituent for the sake of w peppermint is cultivated, is the essential oil, *Oleum Menthæ piperi* colourless, pale yellow, or greenish liquid, of sp. gr. varying from 0·(0·92. It has a strong and agreeable odour, with a powerful arot taste, followed by a sensation of cold when air is drawn into the m We find that the Mitcham oil examined by polarized light in a col 50 mm. long, deviates 14·2° to the left.

When oil of peppermint is cooled to −4° C., it sometimes de colourless hexagonal crystals of *Peppermint Camphor*, $C^{10}H^{18}$ + called also *Menthol*. This camphor (the deposit of which in the c have not observed) boils at 210° C. and possesses the odour of the oil; it deviates the ray of polarized light to the left. The proporti menthol contained in oils of different origin is very variable. crystallized menthol is sometimes found in commerce under the na *Chinese Oil of Peppermint.*[1]

The liquid part of the oil of peppermint has not yet been chem investigated.

Oil of peppermint is not uniform in constitution, nor in its fl and chemical behaviour. Accurate means of ascertaining its valu purity are wanting.

If 50 to 70 drops of peppermint oil are shaken with one dr nitric acid, sp. gr. about 1·2, the mixture changes from faintly yell to brownish and, after an hour or two, exhibits a bluish, violet or gr colour; in reflected light, it appears reddish and not transparent. colour thus produced lasts a fortnight. We have thus examine various samples of peppermint oil at our command, and may state the finest among them assume the most beautiful coloration and escence, which however shows very appreciable differences. An rior oil of American origin was not coloured; and a very old sam an originally excellent English oil was likewise not coloured by th Menthol, that is to say the Chinese oil of peppermint, is not a when similarly treated.[2] The nitric acid test is not capable of rev adulterations of peppermint oil, for the coloration takes place an oil, to which a considerable quantity of oil of turpentine has added.

Remarkable colorations of a different hue are also display the various kinds of oil of peppermint if other chemical agen mixed with it. Thus green or brownish tints are produced by me *anhydrous* chloral; the oil becomes bluish or greenish or rose-colo shaken with a concentrated solution of bisulphite of sodium. worthy of note that oils of different origin, which cannot be guished by means of nitric acid, exhibit totally different colorati mixed with either of the liquids just named. This behaviour may some use in the examination of commercial sorts of peppermint oi

As to bisulphite of sodium, it yields a solid compound with kinds of peppermint oil, which we have not yet examined.

[1] It is distilled at Canton from a plant which appears to be *Mentha arvensis* L. var. *Javanica* (*M. Javanica* Bl.) The oil was exported from Canton in 1872, to the extent of 800 lb.; it was valued at about lb.—See also Flückiger in *Pharm.* Oct. 14, 1871. 321.

[2] *Pharm. Journ.* Feb. 25, 1871. 6

duction and Commerce—In several parts of Europe as well e United States, peppermint is cultivated on the large scale as a al plant.

England the culture is carried on in the neighbourhood of Mitcham ey, near Wisbeach in Cambridgeshire, Market Deeping in Lin- e, and Hitchin in Hertfordshire.

Mitcham in 1850, there were about 500 acres under cultivation; only about 219 acres.[1] At Market Deeping there were in 1871 50 acres cropped with peppermint. The usual produce in oil may ned at 8 to 12 ℔. per acre. The fields of peppermint at Mitcham l, with a rich, friable soil, well manured and naturally retentive ture. The ground is kept free from weeds, and in other respects lly tilled. The crop is cut in August, and the herb is usually to dry on the ground before it is consigned to the stills. These rge size, holding 1000 to 2000 gallons, and heated by coal; each rnished with a condensing worm of the usual character, which ut into a small iron cage secured by a padlock, in which stands eparator. The distillation is conducted at the lowest possible ture. The water that comes over with the oil is not distilled with lot of herb, but is for the most part allowed to run away, a very ly being reserved as a perquisite of the workmen. The produce ariable, and no facilities exist for estimating it with accuracy.[2] ever stated that a ton of dried peppermint yields from 2½ to 3½ of oil, which equals 0·11 to 0·15 per cent. But we have been by a grower at Mitcham that the yield is as much as 6 pounds on, or 0·26 per cent.

Mitcham and its neighbourhood, two varieties of peppermint are nt recognized, the one being known as *White Mint*, the other as *int*, but the differences between the two are very slight. The int has *purple* stems; the White Mint, *green* stems, and as we served, leaves rather more coarsely serrated than those of the The Black Mint is more prolific in essential oil than the White, e more generally cultivated; but the oil of the latter is superior acy of odour and commands a higher price. White Mint is be principally grown for drying in bundles, or as it is termed *g*."

ermint is grown on a vastly larger scale in America, the localities e cultivation is carried on being Southern Michigan, Western rk, and Ohio. In Michigan where the plant was introduced in ere were in 1858 about 2100 acres devoted to its growth, all with ption of about 100 acres being in the county of St. Joseph. age produce of this district was estimated in 1858, at 15,000 ℔; yield fluctuates enormously, and in the exceptionally fine f 1855, it was reckoned at 30,000 ℔. We must suppose that it nuch larger, for we have been informed by Mr. H. G. Hotchkiss, , Wayne County, State of New York, one of the most well- distillers, in a letter under date Oct. 10, 1871, that the quantity

. *Journ.* x. (1851) 297. 340; also *Pharm. Journ.* vi. (1865) 257. pers and to personal inquiries we d for most of the particulars re- ppermint culture at Mitcham.

The larger growers have stills. These they let to smaller cultivators who pay so much for distilling a charge, *i.e.* whatever the still can be made to contain, without reference to weight. Hence the dried herb is preferred to the fresh, as a larger quantity can be distilled at one time.

sent out by him in the previous year, reached the enormous amount of 57,365 lb. From the statistics quoted by Stearns[1] it would appear that the produce of oil per acre is somewhat higher than in England, but from various causes, information on this head cannot be very reliable.

Peppermint is cultivated at Sens in the department of the Yonne in France[2] and in Saxony, and very recently it has been tried in the Neilgherry Hills in Southern India.

Peppermint oil varies greatly in commercial value, that of Mitcham commanding twice or three times as high a price as the finest American. Even the oil of Mitcham is by no means uniform in quality, certain plots of ground affording a product of superior fragrance. A damp situation or badly drained ground, is well known to be unfavourable both to the quantity and quality of oil.

The presence of weeds among the peppermint is an important cause of deterioration to the oil, and at Mitcham some growers give a gratuity to their labourers to induce them to be careful in throwing out other plants when cutting the herb for distillation. One grower of peppermint known to us was compelled to abandon the cultivation, owing to the enormous increase of *Mentha arvensis* L. which could not be separated and which when distilled with the peppermint ruined the flavour of the latter. In America great detriment is occasioned by the growth of *Erigeron Canadense* L. Newly cleared ground planted with peppermint is liable to the intrusion of another plant of the order *Compositæ*, *Erechtites hieracifolia* Raf., which is also highly injurious to the quality of the oil.[3]

Uses—A watery or spirituous solution of oil of peppermint is a grateful stimulant, and is a frequent adjunct to other medicines. Oil of peppermint is extensively consumed for flavouring sweetmeats and cordials.

HERBA PULEGII.

Pennyroyal[4]; F. *Menthe pouliot, Pouliot vulgaire*; G. *Poli.*

Botanical Origin—*Mentha Pulegium* L., a small perennial aromatic plant, common throughout the south of Europe and extending northward to Sweden, Denmark, England and Ireland, eastward to Asia Minor and Persia, and southward to Abyssinia, Algeria, Madeira and Teneriffe. It has been introduced into North[5] and South America. For medicinal use it is cultivated on a small scale.

History—Pennyroyal was in high repute among the ancients. Both Dioscorides and Pliny describe its numerous virtues. In Northern Europe it was also much esteemed, as may be inferred from the frequent reference to it in the Anglo-Saxon works on medicine.

[1] To whose paper *On the Peppermint Plantations of Michigan* in the *Proceedings of the Americ. Pharm. Assocn.* for 1858, we owe the few particulars for which we can here afford space.

[2] *Journ. de Pharm.* viii. (1868) 130.—Abstract from *Roze, La Menthe poivrée, sa culture en France, ses produits, falsifications de l'essence et moyens de les reconnaître*, Paris 1868. 43 pages.

[3] Maisch, *American Journ. of Pharm.* March 1870. 120.

[4] *Pennyroyal*, in old herbals *Puliol royal*, is derived from *Puleium regium*, an old Latin name given from the supposed efficacy of the plant in destroying fleas (Prior).

[5] The native Pennyroyal is however a different plant, namely *Hedeoma pulegioides* Pers.

Gerarde considered the plant to be "so exceedingly well known to all our English nation" that it needed no description. In his time (*circa* 1590), it used to be collected on the commons round London, whence it was brought in plenty to the London markets. At the present day pennyroyal has fallen into neglect, and is not named in the British Pharmacopœia of 1867.

Description—The plant has a low, decumbent, branching stem, which in flowering rises to a height of about 6 inches. Its leaves, barely an inch in length and often much less, are petiolate, ovate, blunt, crenate at the margin, dotted with oil-glands above and below. The flowers are arranged in a series of dense, globose whorls, extending for a considerable distance up the stem. The whole plant is more or less hairy. It has a strong fragrant odour, less agreeable to most persons than that of peppermint or spearmint. Its taste, well perceived in the distilled water, is highly aromatic.

Chemical Composition—The most important constituent of pennyroyal is the essential oil, known in pharmacy as *Oleum Pulegii*, to which is due the odour of the plant. It has been examined by Kane,[1] according to whom it has a sp. gr. of 0·927. Its boiling was found to fluctuate between 183° and 188° C. The formula assigned to it by this chemist is $C^{10}H^{16}O$.

Production—Pennyroyal is cultivated at Mitcham and is mostly sold dried; occasionally the herb is distilled for essential oil. The oil found in commerce is however chiefly French or German, and far less costly than that produced in England.

Uses—The distilled water of pennyroyal is carminative and antispasmodic, and is used in the same manner as peppermint water.

HERBA THYMI VULGARIS.

Garden Thyme; F. Thym vulgaire; G. Thymiankraut.

Botanical Origin—*Thymus vulgaris* L., a small, erect, woody shrub reaching 8 to 10 inches in height, gregarious on sterile uncultivated ground in Portugal, Spain, Southern France and Italy, and in the mountainous parts of Greece. On Mont Ventoux near Avignon, it reaches an elevation above the sea of 3700 ft. (Martins). It is commonly cultivated in English kitchen gardens as a sweet herb.[2]

History—Garden thyme was commonly cultivated in England in the 16th century, and was well figured and described by Gerarde. It is said to have been formerly grown on a large scale for medicinal use in the neighbourhood of Deal and Sandwich in Kent.[3] *Thymol* or the *Camphor of Thyme* was described by Neumann, apothecary to the Court at Berlin in 1725.[4]

Description—The plant produces thin, woody, branching stems, bearing sessile, linear-lanceolate, or ovate-lanceolate leaves. These are

[1] *Phil. Mag.* xiii. (1838) 442.

[2] In many of the references to thyme, Wild Thyme (*Thymus Serpyllum* L.) is to be understood, and not the present species.

[3] Booth in *Treasury of Botany*, ii. (1866) 1149.

[4] *Phil. Trans.* No. 389.

about ¼ of an inch long, revolute at the margin, more or less hoar especially on the under side, and dotted with shining oil-glands. Th small purple flowers are borne on round terminal heads, with sometim a few lower whorls. The entire plant has a greyish tint by reason of short white pubescence. It is extremely fragrant when rubbed, and h a pungent aromatic taste.[1]

Production of Essential Oil—Though cultivated in gardens f culinary use, common thyme is not grown in England on a la scale. Its essential oil (*Oleum Thymi*), for which alone it is of inter to the druggist, is distilled in the south of France. In the neighbo hood of Nîmes, where we have observed the process, the entire plant used, and the distillation is carried on at two periods of the year, nam in May and June when the plant is in flower, and again late in t autumn. The oil has a deep, reddish-brown colour, but becomes colo less though rather less fragrant by re-distillation. The two sorts of termed respectively *Huile rouge de Thym* and *Huile blanche de Thym*, found in commerce.

Oil of thyme is frequently termed in English shops *Oil of Origan* which it in no respect resembles, and which was never, so far as know, found in commerce.[2]

Chemical Composition—The only constituent of the herb t has attracted any attention is the above-named essential oil. T liquid by fractional distillation, is resolved into two portions; the fi more volatile and boiling between 178° and 180° C., is a mixture of t hydrocarbons, *Cymene* $C^{10}H^{14}$, and *Thymene* $C^{10}H^{16}$.

The second named *Thymol*, $C^{10}H^{14}O$, is a solid crystalline substan having a strong aromatic smell, not quite like that of the crude oil, a a sharp burning taste. It is optically inert; it boils at 230° C.; dissol in about 330 parts of water, and very readily in alcohol, ether, or glac acetic acid. It also dissolves in and combines with aqueous alkal solutions. Thymol is homologous with phenol or phenyl-alcohol (carb acid), and isomeric with cuminic alcohol, carvol and carvacrol.[3]

Uses—Oil of thyme is an efficient external stimulant, and is so times employed as a liniment. Its chief consumption is in veteri medicine. Thymol has been proposed as a disinfectant in the plac carbolic acid, in cases in which the odour of the latter is objection The herb is not used in modern English medicine, but is often emplo on the Continent.

HERBA ROSMARINI.

Herba Anthos; Rosemary; F. *Romarin;* G. *Rosmarin.*

Botanical Origin—*Rosmarinus officinalis* L., an evergreen sh attaining a height of 3 to 4 feet or more, abundant on dry rocky hill the Mediterranean region, from the Spanish peninsula to Greece Asia Minor. It generally prefers the neighbourhood of the sea,

[1] This description is from wild specimens; as seen in English gardens, the plant is more luxuriant, greener and far less tomentose.

[2] For a note on *True Oil of Origanum*, see *Pharm. Journ.* x. (1851) 324.

[3] For further information consult Gm *Chemistry*, xiv. (1860) 183. 311. 409. al article on *Ajowan*, at page 270.

curs even in the Sahara, where it is collected and conveyed by caravans to Central Africa.[1]

History—Rosemary[2] is mentioned by Pliny, who ascribes to it numerous virtues. It was also familiar to the Arab physicians of Spain, one of whom, Ibn Baytar (13th cent.), states it to be an object of trade among the vendors of aromatics.[3] In the middle ages, rosemary was doubtless much esteemed, as may be inferred from the fact that it was one of the plants which Charlemagne ordered to be grown on the imperial farms. John Philip de Lignamine,[4] a writer of the 15th century, describes it as the usual condiment of salted meats. It was probably in cultivation in Britain prior to the Norman Conquest, as it is recommended for use in an Anglo-Saxon herbal of the 11th century.[5] The essential oil was distilled by Raymundus Lullius[6] about A.D. 1330.

Description—Rosemary has sessile, linear, entire, opposite leaves about an inch in length, revolute at the margin; they are of coriaceous texture, green and glabrous above, densely tomentose and white beneath. Examined under a lens, the tomentum both of the leaves and young shoots is seen to consist of white stellate hairs; in that of the shoots which is less dense, minute oil-glands are discernible. These glands are of two kinds, large and small, and probably do not yield one and the same oil. The flowers have a campanulate 2-lipped calyx, and a pale blue and white corolla, the upper lip of which is emarginate and erect, the lower 3-lobed with the central lobe concave and pendulous. The whole plant has a very agreeable smell and a strong aromatic taste. It flowers in the early spring.

Production of Essential Oil—Rosemary is cultivated on a very small scale in English herb-gardens, and though a little oil has been occasionally distilled from it, English oil of rosemary is an article practically unknown in commerce. That with which the market is supplied, is produced in the south of France and on the contiguous coast of Italy. The plant which is plentifully found wild, is gathered in summer (not while in flower) and distilled, the operator being sometimes an itinerant herbalist who carries his copper alembic from place to place, erecting it where herbs are plentiful, and where a stream of water enables him to build a condenser of primitive construction.

Oil of rosemary is also produced on a somewhat large scale in the island of Lesina, south of Spalato in Dalmatia, whence it is exported by way of Trieste, even to France and Italy, to the extent of 300 to 350 quintals annually.[7]

Some of the French manufacturers of essences offer oil of rosemary at a superior price as drawn *from the flowers*, by which we presume is meant the *flowering tops*, for the separation of the actual flowers would be impracticable on a large scale. The great bulk of the oil found in commerce is however that distilled from the entire plant.

[1] Duveyrier, *Les Touaregs du Nord*, 1864.

[2] From *ros* and *marinus*,—literally *marine*. Various opinions have been held as to the allusion conveyed by the name.

[3] Sontheimer's translation, i. 73.

[4] *Conservatorium Sanitatis*, cap. 81.

[5] *Herbarium Apuleii—Leechdoms &c. of Early England*, i. (1864) 185.

[6] Manget, *Bibliotheca chemica curiosa*, Genevæ, i. (1702) 829.

[7] Unger, *Der Rosmarin und seine Verwendung in Dalmatien—Sitzungsberichte der Wiener Akademie*, lvi. (1867) 586.

Chemical Composition—The peculiar odour of rosemary depends on the essential oil, which is the only constituent of the plant that has afforded matter for chemical research. This oil is a yellowish liquid of variable sp. gr. (0·908, Gladstone), which boils at 166·5°—168° C. (Kane) and turns the plane of polarization to the right. Gladstone (1864) found it to consist almost wholly of a hydrocarbon, resembling that from *Myrtus communis*, $C^{10}H^{16}$. Lallemand by fractional distillation, resolved oil of rosemary into two liquids,—the one a mobile hydrocarbon boiling at 165° C. and turning the plane of polarization to the left; the other boiling between 200° and 210° C., deposits when exposed to a low temperature, a large quantity of camphor, resembling in all respects common camphor except that it has rather less dextro-rotatory power.[1] Oil of rosemary, acted upon by bichromate of potassium and sulphuric acid, gives rise to *Limettic Acid*, $C^{11}H^{8}O^{6}$, a colourless crystalline substance.

Uses—The flowering tops and dried leaves are kept by the herbalists, but are not used in regular medicine. The volatile oil is employed as an external stimulant in liniments, and also as a perfume. Rosemary is popularly supposed to promote the growth of the hair.

PLANTAGINEÆ.

SEMEN ISPAGHULÆ.

Ispaghúl Seeds, Spogel Seeds.

Botanical Origin—*Plantago decumbens* Forsk. (*P. Ispaghula* Roxb.),[2] a plant of variable aspect, from an inch to a foot in height, erect or decumbent, with linear lanceolate leaves which may be nearly glabrous, or covered with shaggy hairs. The flower-spikes differ according to the luxuriance of the plant, being in some specimens cylindrical and 1½ inches long, in others reduced to a globular head. The plant has a wide range, occurring in the Canary Islands, Egypt, Arabia, Beluchistan, Afghanistan, and North-western India. Stewart[3] says it is common in the Peshawur valley and Trans-Indus generally up to 2000 feet; also on the plains and lower hills of the Punjab, but that he has never seen it cultivated in the latter region. It is said to be cultivated at Multan and Lahore, also in Bengal and Mysore.

History—The seeds which are found in all the bazaars of India and are held in great esteem, are generally designated by the Persian word *Ispaghúl;* but they also bear the Arabic name *Bazre-qatúná*, under which we find them mentioned by the Persian physician Alhervi[4] in the 10th century, and about the same period or a little later, by Avicenna.[5] Several other Oriental writers are quoted by Ibn Baytar[6] as referring to a drug of the same name, which may possibly have included the seeds

[1] Gmelin, *Chemistry*, xiv. (1860) 397.

[2] After the examination of numerous specimens, we adopt the course taken by Dr. Aitchison (*Catalogue of the Plants of the Punjab and Sindh*, Lond. 1869) of uniting *P. Ispaghula* to *P. decumbens*. The union of species in this group may probably be carried still further.

[3] *Punjab Plants*, Lahore 1869. 174—also MS. note attached to specimens in Herb. Kew.

[4] *Liber Fundamentorum Pharmacologiæ*, ed. Seligmann, Vindobonæ, 1830. 40.

[5] Lib. ii. tract. 2. c. 541. (Valgrisi edition 1564. i. 357.)

[6] Sontheimer's transl. i. (1840. 132

other species, as *Plantago Psyllium* L., and *P. Cynops* L., having similar properties, and known to have been used from an early period.

The Indian *Ispaghúl* attracted the notice of Europeans towards the close of the last century,[1] and has been often prescribed as a demulcent in dysentery and diarrhœa. It was admitted to the *Pharmacopœia of India* of 1868.

Description—The seeds, like those of other species of *Plantago*, are of boat-shaped form, the albumen being deeply furrowed on one side and vaulted on the other. They are a little over $\frac{1}{10}$ of an inch in length and nearly half as broad, and so light that 100 weigh scarcely three grains. Their colour is a light pinkish grey with an elongated brown spot on the vaulted back, due to the embryo, which at this point is in close contact with the translucent testa. From this brown spot, the thick radicle runs to the top of the seed. The hollow side of the seed is also brown and partially covered with a thin white membrane.

The seeds are highly mucilaginous in the mouth, but have neither taste nor odour. Those of the allied *P. Psyllium* have nearly the same form, but are shining and of a dark brown hue.

Microscopic Structure—This can be best investigated by immersing the seed in benzol, as in this medium the mucilage is insoluble. When thus examined, the whole surface is seen to consist of polyhedral cells, separated by a very thin brown layer from the albumen, which on the back of the seed is only 70 mkm. thick. The albumen is made up of thick-walled cells, loaded with granules of matter which acquires an orange hue on addition of iodine. The two cotyledons adhere in a direction perpendicular to the bottom of the furrow; their tissue is composed of thin-walled smaller cells, containing also albuminous granules and drops of fatty oil.

If the seed is immersed in water, the cells composing the epidermis instantly swell and elongate, and soon burst, leaving only fragments of their walls. When examined under glycerin, the change is more gradual, and the outer walls of the cells yielding the mucilage display a series of thin layers, which slowly swell and disappear by the action of water. The mucilage is consequently not contained within the cells, but is formed of the secondary deposits on their walls, as in linseed and quince pips.

Chemical Composition—Mucilage is so abundantly yielded by these seeds, that one part of them with 20 parts of water, forms a thick tasteless jelly. On addition of a larger quantity of water and filtering, but little mucilage passes, the greater part of it adhering to the seeds. The mucilage separated by straining with pressure, does not redden litmus, is not affected by iodine, nor precipitated by borax, alcohol or ferric chloride. The fat oil and albuminous matter of the seed, have not been examined.

Uses—A decoction of the seeds (1 p. to 70 p. of water) is employed in India as a cooling, demulcent drink. The seeds powdered and mixed with sugar, or made gelatinous with water, are sometimes given in chronic diarrhœa.

[1] Fleming, *Catal. of Indian Med. Plants and Drugs*, Calcutta, 1810. 31.

POLYGONACEÆ.

RADIX RHEI.

Rhubarb; F. *Rhubarbe;* G. *Rhabarber.*

Botanical Origin—*Rheum officinale* Baillon, a perennial plant resembling the Common Garden Rhubarb, but of larger size. It differs from the latter in several particulars: the leaves spring from a distinct crown rising some inches above the surface of the ground; they have a sub-cylindrical petiole, which as well as the veins of the under side of the lamina is covered with a pubescence of short erect hairs. The lamina, the outline of which is orbicular, cordate at the base, is shortly 5- to 7-lobed, with the lobes coarsely and irregularly dentate; it attains 4 to 4½ feet in length and rather more in breadth.

The plant was discovered in South-eastern Tibet, where it is said to be often cultivated for the sake of its medicinal root; but it is supposed to grow in various parts of Western and North-western China, whence the supplies of rhubarb are derived. It was obtained by the French missionaries about the year 1867 for Dabry, French Consul at Hankow, who transmitted specimens to Soubeiran of Paris. From one of these which flowered at Montmorency in 1871, a botanical description was drawn up Baillon.[1]

Whether the rhubarb of commerce is derived exclusively from this plant is not known. But that the latter is a true source of the drug is supported by the fact, that there is at least no important discrepancy between it and the accounts and figures, scanty and imperfect though they are, given by Chinese authors and the old Jesuit missionaries; and still more by the agreement in structure which exists between its root and the Asiatic rhubarb of commerce.[2]

History—The Chinese appear to have been acquainted with the properties of rhubarb from a period long anterior to the Christian era, for the drug is treated of in the herbal called *Pen-king*, which is attributed to the Emperor Shen-nung, the father of Chinese agriculture and medicine, who reigned about 2700 B.C.[3]

As regards Western Asia and Europe, we find a root called ῥᾶ or ῥῆον, mentioned by Dioscorides as brought from beyond the Bosphorus. The same drug is alluded to in the fourth century by Ammianus Marcellinus,[4] who states that it takes its name from the river Rha (the modern Volga), on whose banks it grows. Pliny describes a root termed *Rhacoma*, which when pounded, yielded a colour like that of wine but inclining to saffron, and was brought from beyond Pontus.

The drug thus described, is usually regarded as rhubarb, or at least as the root of some species of *Rheum*, but whether produced in the regions of the Euxine (Pontus), or merely received thence from remote countries, is a question that cannot be solved.

[1] *Adansonia*, x. 246; *Association Française pour l'avancement de la Science*, Comptes Rendus de la 1re Session, 1872. 514-529. pl. x.

[2] We have particularly examined the very large root of a plant of *R. officinale* cultivated by one of us at Clapham Common near London.

[3] Bretschneider, *Chinese Botanical Work*, Foochow, 1870. 2.

[4] *Scriptores Historiæ Romanæ latini veteres*, ii (1743) 511 (Amm. Marc. xxii. 8).

wever certain that the name *Radix pontica* or *Rha ponticum*, :ribonius Largus[1] and Celsus,[2] was applied in allusion to whence the drug was received. Lassen has shown that avans from Shensi in Northern China arrived at Bokhara as year 114 B.C. Goods thus transported might reach Europe ay of the Black Sea, or by conveyance down the Indus to the rt of Barbarike. Vincent suggests[3] that the *rha* imported t route would naturally be termed *rha-ponticum*, while that the second might be called *rha-barbarum*.

not prepared to accept this plausible hypothesis. It receives t from the author of the Periplus of the Erythrean Sea 54), whose list of the exports of Barbarike[4] does not include nor is rhubarb named among the articles on which duty at the Roman custom-house of Alexandria (A.D. 176–180).[5]

ms *Rheum barbarum* vel *barbaricum* or *Reu barbarum* occur itings of Alexander Trallianus[6] about the middle of the 6th id in those of Benedictus Crispus,[7] archbishop of Milan, and Seville, who both flourished in the 7th century. Among the riters on medicine, the younger Mesue, in the early part of century, mentions the rhubarb of China as superior to the r Turkish.[9] Constantinus Africanus[10] about the same period, Indian and Pontic *Rheum*, the former of which he declares to ble.

b in the 12th century was probably imported from India, as we from the tariff of duties levied at the port of Acon in Syria, in ment[11] it is enumerated along with many Indian drugs. A similar 1271, relating to Barcelona, mentions *Ruibarbo*.[12] In a statute of Pisa called the *Breve Fundacariorum*, dating 1305, rhubarb is classified with commodities of the Levant and India.[13]

st and almost the only European who has visited the rhubarb-ountries of China, is the famous Venetian traveller, Marco o speaking of the province of Tangut says—". . et par toutes nes de ces provinces se treuve le *reobarbe* en grant habondance. chatent les marchans et le portent par le monde."

ch of the history of rhubarb would be incomplete without rence to the various routes by which the drug has been to Europe from the western provinces of the Chinese Empire,

sitione Medicamentorum, c. 167.
ind, lib v. c. 23.
Commerce and Navigation of ii. (1807) 389.
cit. ii. 390.
. *cit.* ii. 686.
. c. 3 (Haller's edition.)
Patrologiæ Cursus, lxxxix. 374.
p. cit., lxxxii. 628. The expla- by Isidore is this:—"*Reubar- Reuponticum*: illud quod trans solo barbarico; istud quod circa igitur, nominatum est. *Reu* an- citur. *Reubarbarum* ergo, quasi *ra Reuponticum* quasi *radix* But Isidore was fond of such

[9] *Ravedsceni*, *Raved barbarum*, and *Raved Turchicum* are the terms used in the Latin translation we have consulted.

[10] *De omnibus medico cognitu necessariis*, Basil. 1539. 354.

[11] *Assises de Jérusalem* contained in the *Recueil des Historiens des Croisades*, *Lois*, ii. (1843) 176.

[12] Capmany, *Memorias de . . . Barcelona*, i. (1779) 44

[13] Bonaini, *Statuti inediti della città di Pisa dal xii al xiv secolo*, iii. (Firenze, 1857) 106. 115.

[14] Pauthier, *Le Livre de Marco Polo . . . rédigé en français sous sa dictée en 1298 par Rusticien de Pise*, i. (1865) 165. ii. 490. — The ancient kingdom of Tangut is partially included in the modern province of Kansuh.

and which have given rise to the familiar designations of *Russian*, *Turkey* and *China Rhubarb*.

The *first* route is that over the barren steppes of Central Asia by Yarkand, Kashgar, Turkestan, and the Caspian to Russia; the *second* by the Indus or the Persian Gulf to the Red Sea and Alexandria, or by Persia to Syria and Asia Minor; and the *third* by way of Canton, the only port of the Chinese Empire which previous to the year 1842, held direct communication with Europe.

In 1653, China first permitted Russia to trade on her actual frontier. The traffic in Chinese goods was thereupon diverted from the line of the Caspian and Black Sea further north, taking its way from Tangut across the steppes of the high Gobi, and through Siberia by Tobolsk to Moscow. Thus it is mentioned in 1719, that Urga on the north edge of the Gobi desert, was the principal depôt for rhubarb. From the earliest times, Bucharian merchants appear to have been agents in this traffic, the producers of the drug never concerning themselves about its export.

Consequent on the rectification of frontier in 1728, a line of custom-houses was established by treaty between Russia and China, whereby the commerce, previously unrestricted, was limited to the government caravans which passed the frontier only at Kiachta and at Zuruchaita, south of Nerchinsk. The latter place always remained unimportant, while Kiachta and the opposite Chinese town of Maimatchin became the staple depôts of rhubarb.

The root was subjected to special control as early as 1687–1697 by the Russian Government, who finally monopolized the trade about 1704. Caravans fitted out by the Crown, alone brought the drug to Moscow, until 1762, when the caravan-trade was for a while thrown open. It was not until this period that the export of rhubarb became considerable, although the stringent regulations established in 1736, were still maintained. The surveillance of rhubarb was exercised at Kiachta in a special court or office called the *Brake*,[1] under instructions from the Russian Minister of War, by an apothecary appointed for six years, the object being to remove from the rhubarb brought for inspection, all inferior or spurious pieces, and to improve the selected drug by trimming, paring and boring. It was then carefully dried, and packed in chests, which were sown up in linen and rendered impervious to wet, by being pitched and then covered with hide. The drug was dispatched, but only in quantities of 1000 *puds* (40,000 lb.), once a year by way of Lake Baikal and Irkutsk to Moscow, whence it was transmitted to St. Petersburg, to be there delivered to the Crown apothecaries and in part to be sold to druggists.

We are indebted for these accounts chiefly to Calau,[2] an apothecary appointed to supervise the examination of rhubarb, and who resided a long time at Kiachta. An exact account of the remarkable policy of the Russian Government in relation to that drug, was also given by Von Schröders[3] in 1864.

So long as China kept all her ports closed to foreign commerce, except Canton in the extreme south, a large supply of fine rhubarb

[1] From the German word *Bracke*, the name applied to persons appointed for the examination of merchandize brought to the ports of the Baltic.

[2] Gauger's *Rep. für Pharm. und Chem.* 1842, 452–457; *Pharm. Journ.* ii. (1843 65.

[3] Canstatt's *Jahresbericht* for 1864: 35–42.

l its way to Europe by way of Russia. But the unpleasant npaniments of the Russian supervision, which was exercised with aring severity,[1] and the extreme tediousness of the land-transport, the Chinese very ready to accept an easier outlet for their goods. rdingly we find that the opening of a number of ports in the of China, exerted a very depressing influence on the trade of hta, which was augmented by the rebellion that raged in the interior hina for some years from 1852.

On these accounts, Russia in 1855 removed certain restrictions on rade, though without abandoning the Rhubarb Office. She withdrew 360, the custom-houses to Irkutsk, and declared Kiachta a free port, e by the treaty with China of November 1860, she insisted on that ntry abandoning all restrictions on trade.

But the over-land rhubarb trade had already been destroyed: the ese tempted by the increased demand occasioned by the new trading-s, became less careful in the collection and curing of the root, while Russians insisted with the greatest strictness on the drug being of the stomed quality. Hence it happened that from 1860, hardly any barb was delivered at Kiachta, either for the government use or to ate traders; and in 1863, the Rhubarb Office was abolished.

Thus, the so-called *Russian* or *Muscovitic* or *Crown Rhubarb*, iliarly known in England as *Turkey Rhubarb*, a drug which for its formly good quality long enjoyed the highest reputation, has become ing of the past, which can only now be found in museum collections. egan to appear in English commerce at the commencement of the century. Alston,[2] who lectured on botany and materia medica at nburgh in 1720, speaks of rhubarb as brought from Turkey and the Indies,—"and of late, likewise from Muscovy."

It has been shown (p. 443) that rhubarb was shipped from Syria in the century. Vasco da Gama[3] mentions it in 1497, among the exports Alexandria. In fact, the drug was carried from the far east to Persia, nce it was brought by caravans to Aleppo, Tripoli, Alexandria, and to Smyrna. From these Levant ports it reached Europe, and was ibuted as *Turkey Rhubarb;* while that which was shipped direct China, or by way of India, became known as *China*, *Canton*, or *India Rhubarb*. The latter was already the more common sort in land as early as 1640.[4]

As the rhubarb of the Levant disappeared from trade, that of Russia not only its place but likewise its name, until the term "*Turkey barb*" came to be the accepted designation of the drug imported Russia. This strange confusion of terms was not however preva-on the Continent, but was chiefly limited to British trade.

The risk and expense of the enormous land-transport over almost whole breadth of Asia, caused rhubarb in ancient times to be one e very costly drugs. Thus at Alexandria in 1497, it was valued at ve times the price of benzoin. In France in 1542,[5] it was worth imes as much as cinnamon, or more than four times the price of

hus in 1860, the Russians compelled Chinese to burn 6000 lb. of rhubarb, pretext that it was *too small!*

ectures on the Mat. Med. i. (1770) 502.

oteiro da viagem de Vasco da Gama, par A. Herculano e o Barão de Castello de Paiva, ed. 2. Lisboa, 1861. 115.

[4] Parkinson, *Theatrum Botanicum*, 1640. 155.

[5] Leber, *Appréciation de la fortune privée au moyen âge*, éd. 2. 1847. 308-9.

saffron. At Ulm in 1596,[1] it was more costly than opium. A Ger price-list of 1614,[2] shows *Radix Rha Barbari* to be six times as de fine myrrh, and more than twice the price of opium. An official Eq list[3] giving the price of drugs in 1657, quotes opium as 6*s.* pe scammony 12*s.*, and rhubarb 16*s.*

Production and Commerce—The districts of the Chinese Em which produce rhubarb, extend over a vast area. They are comp in the four northern provinces of China Proper, known as Chihli, Sh Shensi,[4] and Honan; the immense north-western province of Ka formerly partly included in Shensi, but now extending across the d of Gobi and to the frontiers of Tibet; the province of Tsing-ha habited by Mongols, which includes the great salt lake of Koko-no the districts of Tangut, Sifan, and Turfan; and lastly the mountai the western province of Szechuen. The plant is found on the turages of the high plateaux, growing particularly well on spots have been enriched by encampments.

What little we further know regarding the production of rhu and its preparation for the market, is due partly to Chinese autho and partly to Catholic missionaries,[5] and is of a rather meagre unsatisfactory character. The root is dug up at the beginnin autumn when the vegetation of the plant is on the decline, and operation is probably continued for a few months, or in some dist for the whole winter. It is cleaned, its cortical part sliced off, the root cut into pieces for drying. This is performed either by th of fire heat, or by simple exposure to sun and air, or the pieces are partially dried on a hot stone, and then strung on a cord and suspe until the desiccation is complete.

Rhubarb is now purchased for the European market chiefly at kow on the upper Yangtsze, whither it is brought from the prov of Shensi, Kansuh, and Szechuen. From Hankow it is sent do Shanghai, and there shipped for Europe. The exports from Ha are thus stated in official documents.[6]

	1866	1867	1868	1869	1870	1871
Peculs[7]	2985	3425	2866	3398	3370	3859

Much smaller quantities (554 peculs in 1872) are shipped Tientsin; and there are occasional exportations from Canton, Amoy Foochow. The imports of rhubarb into the United Kingdom in amounted to 343,306 lb., the estimated value of which was £62,71

Description—China Rhubarb as imported into Europe,[9] consi portions of a massive root which display considerable diversity of

[1] Reichard, *Beiträge zur Geschichte der Apotheken*, Ulm, 1825. 208.

[2] See p. 177, note 3.

[3] *Book of the Values of Merchandize imported, according to which, Excize is to be paid by the First Buyer*, Lond. 1657.

[4] According to Consul Hughes of Hankow, San-yuan in Shensi (north of Singanfu) is one of the principal marts for rhubarb.

[5] Farre in *Pharm. Journ* vii. (1866) 375; Chauveau, Vicar Apostolic of Tibet (1870) and Biet a French missionary both quoted by Collin in his thesis *Des Rhubarbes*, 1871. 22. 24.

[6] *Reports on Trade at the Treaty P China for* 1870; *Commercial Reports* her Majesty's Consuls in China, 1872 p. 57.

[7] 1 pecul = 133⅓ lb.

[8] *Annual Statement of the Trade an vigation of the United Kingdom for* 18

[9] It is now often trimmed by wh druggists to simulate the old Russia barb.

rising from the various operations of paring, slicing and trimming, to which they have been subjected. Thus some pieces are cylindrical or rather barrel-shaped, others conical, while a large proportion are plano-convex, and others again are of no regular shape. These forms are not all found in the same package, the drug being usually sorted into *round* and *flat rhubarb*. In dimensions we find 3 to 4 inches the commonest length, though an occasional piece 6 inches long or more, may be met with. The width may be stated at 2 to 3 inches. The outer surface of the root is somewhat shrivelled, often exhibiting portions of a dark bark that have not been pared away. Many pieces are pierced with a hole, in which may be found the remains of a cord used to suspend the root while drying. The drug is dusted over with a bright brownish-yellow powder, on removal of which the outer side of the root is seen to have a rusty-brown hue, or viewed with a lens to be marked by the medullary rays, which appear as an infinity of short broken lines of deep brown, traversing a white ground.

The character which most readily distinguishes the rhubarb of China, is that well-developed pieces, broken transversely, display these dark lines arranged as an internal ring of *star-like spots*. Although this character is by no means obvious in every piece of Chinese rhubarb, it is of some utility from the fact that in European rhubarb, such spots are generally wholly wanting, or at most occur only sparingly and in an isolated manner.

In judging of rhubarb, great stress is laid upon the appearance of the root when broken, and the circumstance of the fractured surface presenting no symptoms of decay, discoloration, or sponginess.[1] In good rhubarb, the interior is found to be compact, and beautifully veined with reddish-brown and white, sometimes not unmixed with iron-grey. The root when chewed tastes gritty, by reason of the crystals it contains of oxalate of calcium; but it is besides bitter, astringent and nauseous. The odour is peculiar, and except by the druggist, is mostly regarded as very disagreeable.

Microscopic Structure—The tissue of rhubarb is made up of a white parenchyme, brown medullary rays and a few irregularly scattered very large fibro-vascular bundles, which are devoid of ligneous cells.

On a transverse fracture of specimens, which are not too much peeled, a narrow dark cambial zone may be distinguished. In that part of the root, only the medullary rays display the usual radial arrangement, and in the interior of the root no regular structure is met with. There is no well-marked pith, but the central portion of the tissue shows a mixture of white parenchyme and brown medullary rays running in every direction. In full-grown roots, the central part is separated from the cambial zone by the band of stellate patches already mentioned.

As to the contents of the white cells, they are loaded either with branch or tufted crystals of oxalate of calcium, the amount of the latter being especially liable to variation. Scheele, after having discovered the oxalic acid, pointed out in 1784, that the crystals under notice consist

[1] The quality and appearance of rhubarb are far more regarded in England than on the Continent. To insure a fine powder of the best hue, the drug is most carefully prepared, each root being split open, and any dark or decayed portion removed with a chisel or file, while the operator is not allowed to handle the drug except with leather gloves.

of that acid in combination with lime. The medullary rays contain the substances peculiar to rhubarb, but none of them occur in a crystalline state.

Chemical Composition—The active constituent of the root has long been supposed to reside in the yellowish red contents of the medullary rays. Schrader as early as 1807, prepared a *Rhubarb-Bitter*, to which he attributed the medicinal powers of the drug. Since then, several substances of the same kind have been separated by various methods, and described under different names: such are the *Rhabarberstoff* of Trommsdorff, the *Rheumin* of Hornemann, the *Rhabarberin* of Buchner and Herberger, the *Rhubarb-Yellow* or *Rheïn*, and the *Rhabarbic Acid* of Brandes.

Schlossberger and Döpping in 1844, first recognized among the above-named substances, a definite chemical body named *Chrysophan* or *Chrysophanic Acid*, $C^{14}H^{8}O^{4}$, which had been previously found by Rochleder and Heldt in the yellow lichen, *Parmelia parietina*. It partly forms the yellow contents of the medullary rays of rhubarb, and when isolated, crystallizes in golden yellow needles or in plates. It dissolves in ether, alcohol, or benzol; though scarcely soluble in water, it is nevertheless extracted from the root to some extent by that solvent, probably by reason of some accompanying substances. Alkalis dissolve it, forming fine dark red solutions.

By precipitating alcoholic solutions of extract of rhubarb with ether, Schlossberger and Döpping obtained together with chrysophan, three resinous bodies which they named *Aporetin*, *Phæoretin*, and *Erythroretin*.

De la Rue and Miller (1857) extracted from rhubarb in addition to chrysophan, an allied substance, *Emodin*, which crystallizes in orange-coloured prisms, sometimes as much as two inches long. Its composition was found to agree with the formula $C^{40}H^{30}O^{13}$.

The latest researches on this difficult subject are those of Kubly,[1] who has obtained from rhubarb the following constituents:—

1. *Rheo-tannic Acid*, $C^{26}H^{26}O^{14}$, a yellowish powder abundantly present in rhubarb, soluble in water or alcohol, not in ether. Its solutions produce blackish-green precipitates with persalts of iron, and greyish ones slowly turning blue, with protosalts of the same.

2. *Rheumic Acid (Rheumsäure)*, $C^{20}H^{16}O^{9}$, obtained as a reddish-brown powder, by boiling rheo-tannic acid with a dilute mineral acid, a fermentable sugar being developed at the same time. Rheumic acid exhibits nearly the same reactions as rheo-tannic acid, but is very sparingly soluble in cold water. It partly pre-exists in rhubarb.

3. Neutral colourless substance, sparingly soluble in hot water, and separating from the latter in prismatic crystals of the formula $C^{10}H^{12}O^{6}$; no name has yet been given to it.

4. *Phæoretin*, $C^{16}H^{16}O^{7}$, agreeing with the substance thus named by Schlossberger and Döpping. It is a brown powder, soluble in alcohol or in acetic acid, but not in ether, chloroform or water.

5. *Chrysophan*, described above; it agrees in composition with *Alizarin*.

A *pectic matter*, which abounds in rhubarb, has not yet been satisfactorily examined. As to the mineral constituents, their amount is

[1] *Pharm. Zeitschrift f. Russland*, vi. (1867) 603–627; abstract in Wiggers and Husemann's *Jahresbericht* for 1867. 40.

eedingly variable. Two samples of good China Rhubarb dried at f C. and incinerated, yielded respectively 12·9 and 13·87 per cent of . Another sample which we had particularly selected on account its pale tint, afforded no less than 43·27 per cent. of ash. The ash nists of carbonates of calcium and potassium. English rhubarb from ıbury (portions of a large specimen) left after incineration 10·90 per t. of ash.

From a practical point of view the chemical history of rhubarb is far n satisfactory, for we are still ignorant to what principle the drug owes therapeutic value, or what the pharmaceutical preparations in which active matter may be most appropriately exhibited. Chrysophan aid to act as a purgative, but less powerfully than rhubarb itself.

Uses—Rhubarb is one of the commonest and most valuable purga-s; it is also taken as a stomachic and tonic.

Substitutes—These are found in the roots of the various species of *rum*, cultivated in Europe. In most countries, the cultivation of ıbarb for medicinal use has at some time been attempted. Yet in ; few instances has it been persistently carried on; and though the g produced has often been of good appearance and by no means oid of the characteristic properties of Asiatic rhubarb, it has failed gain the confidence of medical men, and to acquire much importance he drug-market.

These results are doubtless owing in large measure to the species of *rum* cultivated, which has never been that which yields the finest inese rhubarb. Now that the true kind has been obtained, a much ter success may be anticipated.[1] The European rhubarb most inte-ting from our point of view is

English Rhubarb—So early as 1535, Andrew Boorde, an English thusian monk and practitioner of medicine, obtained seeds of rhubarb, ch he sent as "*a grett tresure*" to Sir Thomas Cromwell, Secretary State to Henry VIII.; but as he says they "*come owtt of barbary,*" must be allowed to hold their genuineness as doubtful.[2]

In the following century, namely about the year 1608, Prosper Alpinus 'adua cultivated as the True Rhubarb, a plant which is now known *heum Rhaponticum* L., a native of Southern Siberia and the regions of Volga.[3] From this stock, Sir Matthew Lister, physician to Charles I., ured seeds when in Italy, and gave them to Parkinson,[4] who raised ıts from them.

Collinson obtained rhubarb plants from seeds procured in Tartary, sent to him in 1742, by Professor Siegesbeck of St. Petersburg.[5]

About 1777, Hayward, an apothecary of Banbury in Oxfordshire, menced the cultivation of rhubarb, with plants of *Rh. Rhaponticum*, d from seeds sent from Russia in 1762. The drug he produced was ood that the Society of Arts awarded him in 1789, a silver medal in 1794 a gold medal.[6] The Society also awarded medals about the e time (1789–1793) to growers of rhubarb in Somersetshire, Yorkshire

Mr. Usher of Bodicott near Banbury lready (1873) commenced the cultiva-of *Rheum officinale* Baillon.

Boorde's *Introduction and Dyetary*, re-ed by the Early English Text Society, 56.

[3] Prosper Alpinus, *De Rhapontico*, Lugd. Bat. 1718.

[4] *Theatrum Botanicum*, 1640. 157.

[5] Dillwyn, *Hortus Collinsonianus*, 1843. 45.

[6] *Trans. of Soc. of Arts*, viii. (1790) 75; xii. (1794) 225.

and Middlesex, some of whom, it appears, cultivated *Rh. palmatum* the death of Hayward in 1811, his rhubarb plants came into the poss of Mr. P. Usher, by whose descendants, Mr. R. Usher and sons, th still cultivated at Bodicott, a village near Banbury.

We had the pleasure of inspecting the rhubarb fields of M Usher on Sept. 4. 1872, and of seeing the whole process of prepari root for the market.[1] The land under cultivation is about 17 acr soil being a rich friable loam. The roots are taken from the g during the autumn up to the month of November. It is cons advantageous that they should be 6 or 7 years old, but they are s allowed to attain more than 3 or 4 years. The clumps of root as re from the field to the yard, where the trimming takes place, are o size, weighing with the earth attached to them, as much as 60 or They are partially cleaned, the smaller roots are cut off, and th central portion is rapidly trimmed into a short, cylindrical mass t of a child's head. This latter subsequently undergoes a still f paring, and is finally sliced longitudinally; the other and less va roots are also pared, trimmed, and assorted according to size. Th roots are fleshy, easily cut, and of a beautiful deep yellow. All ar in buildings constructed for the purpose and heated by flues. The occupies several weeks. The root after drying has a shrivelled, un appearance, which may be remedied by paring and filing. The fi drug has to be stored in a warm dry place.

When well prepared, Banbury rhubarb is of excellent appe The finest pieces, which are semi-cylindrical, are quite equal in the drug of China. The colour is as good, and the fractured exhibits pink markings not less distinct and brilliant. Even the s roots which are dried as sticks, have internally a good colour an a fine powder. But the odour is somewhat different from that of C rhubarb; the taste is less bitter but more mucilaginous and astr and the root is of a more spongy, soft, and brittle texture. The ture is the same as that of the Chinese rhubarb, except that, as a stated, the star-like spots, if present, are isolated, and not arrang regular zone.

The drug commands but a low price, and is chiefly sold, it for exportation in the state of powder. It is not easily purch London.

French and German Rhubarb—The cultivation of rhuba commenced in France in the latter half of the last century, a been pursued with some enthusiasm in various localities. The grown were *Rheum palmatum* L., *Rh. undulatum* L., *Rh. compa* and *Rh. Rhaponticum* L. The first was thought by Guibourt - to a root more nearly approaching than any other, the rhubarb of but it is that which is cultivated the least readily, the central roo liable to premature decay. Both this plant and *Rh. undulatum* formerly cultivated by order of the Russian Government on a lar at Kolywan and Krasnojarsk in Southern Siberia, but the cultr we believe, been long abandoned.[3]

[1] No use is made of the leaves.

[2] *Histoire des Drogues*, ii. (1849) 398.

[3] Twelve chests of this rhubarb said to be of the crop of 1793, which had been lying in the Russian Government warehouses, were offered for sale in London, Dec. Samples of the drug now 80 years in my possession and still sound a —D. H.

As to France, it appears from inquiries we have lately made (1873), that except in the neighbourhood of Avignon and in a few other scattered localities, the cultivation has now ceased.

Rheum Rhaponticum is the source of the rhubarb which is produced at Austerlitz and Auspitz in Moravia, and at Ilmitz, Kremnitz and Frauenkirchen in Hungary. Some rhubarb is also produced in Silesia from *Rh. Emodi* Wall. (*Rh. australe* Don.)

MYRISTICEÆ.

MYRISTICA.

Nuclei Myristicæ, Semen Myristicæ, Nux moschata; Nutmeg; F. *Muscade, Noix de Muscade;* G. *Muskatnuss.*

Botanical Origin—*Myristica fragrans* Houttuyn (*M. moschata* Thunb., *M. officinalis* Linn. f.), a handsome, bushy, evergreen tree, with dark shining leaves, growing in its native islands to a height of 40 to 50 feet. It is found wild in Jilolo, Ceram, Amboyna, Bouro, the western peninsula of New Guinea, and in many of the adjacent islands, including the very small volcanic group of Banda, south of Ceram; but it is not indigenous to any of the islands westward of these, or to the Philippines (Rawfurd).

The nutmeg-tree has been introduced into Bencoolen on the west coast of Sumatra, Malacca, Bengal, the islands of Singapore and Penang, as well as Brazil and the West Indies; but it is only in a very few localities that the cultivation has been attended with success.

In its native countries, the tree comes into bearing in its ninth year, and is said to continue fruitful until 60 or even 80 years old, yielding usually as many as 2000 fruits. It is diœcious, and one male tree furnishes pollen sufficient for twenty female.

History—It has been generally believed that neither the nutmeg nor mace was known to the ancients. C. F. Ph. von Martius[1] however maintains that mace was alluded to in the comedies of Plautus,[2] written about two centuries before the Christian era.

The words *Macer, Macar, Machir* or *Macir*, occurring in the writings of Scribonius Largus, Dioscorides, Galen, and Pliny are thought by Von Martius to refer in each instance to mace. But that the substance designated by these names was not mace, but the bark of a tree growing in Ceylon, was pointed out by Acosta nearly three centuries ago, and by many subsequent writers, and as we think, with perfect correctness.[3]

Nutmegs and mace were imported from India at an early date by the Arabians, and thus passed into western countries. Aëtius, who was present at the court of Constantinople about the year 540, appears to have been acquainted with the nutmeg, if that at least is intended by the term *Nuces Indicæ*, prescribed together with cloves, spikenard, costus, and aromaticus and sandal wood, as an ingredient of the *Suffumigium Moschatum*.[4]

[1] *Flora Brasiliensis*, fasc. 11 12. 133; *Buchner's Repertorium für Pharmacie*, (1870) 529-538.

[2] *Mendolus*, act. iii. scena 2.

[3] Guibourt et De Lens, *Dict. de Mat. Méd.* (1873) 173.

[4] Aetius, tetrabiblos iv. serm. 4. c. 122.—It must however be admitted that *Nux Indica* in mediæval authors usually signifies the Coco-nut.

Masudi[1] who appears to have visited India in A.D. 916–920, pointed out that the nutmeg, like cloves, areca nut and sandal wood, was a product of the eastern islands of the Indian Archipelago. The Arabian geographer Edrisi, who wrote in the middle of the 12th century, mentions both nutmegs and mace as articles of import into Aden;[2] and again "*Nois mouscades*" are among the spices on which duty was levied at Acre in Palestine, *circa* A.D. 1180.[3] About a century later, another Arabian author, Kazwini,[4] expressly named the Moluccas as the native country of the spices under notice.

One of the earliest references to the use of nutmegs in Europe, occurs in a poem written about 1195, by Petrus d'Ebulo[5] describing the entry into Rome of the Emperor Henry VI., prior to his coronation in April, 1191. On this occasion, the streets were fumigated with aromatics, which are enumerated in the following line:—

"Balsama, thus, aloë, *myristica*, cynnama, nardus."

By the end of the 12th century, both nutmegs and mace were found in Northern Europe,—even in Denmark, as may be inferred from the allusion to them in the writings of Harpestreng.[6] In England, mace though well known, was a very costly spice, its value between A.D. 1284 and 1377 being about 4*s.* 7*d.* per lb., while the average price of a sheep during the same period was but 1*s.* 5*d.*, and of a cow 9*s.* 5*d.*[7] It was also dear in France, for in the *Compte de l'exécution* of the will of Jeanne d'Evreux, queen of France, in 1372, six ounces of mace are appraised per ounce, at 3 sols 8 deniers, equal to about 8*s.* 3*d.* of our present money.[8]

The use of these spices was diffused throughout Europe long before the Portuguese in 1512 had discovered the mother-plant in the isles of Banda. The Portuguese held the trade of the Spice Islands for about a century, when it was wrested from them by the Dutch, who pursued the same policy of exclusiveness that they had followed in the case of cloves and cinnamon. In order to secure their monopoly, they endeavoured to limit the trees to Banda and Amboyna, and to exterminate them elsewhere, which in fact they did at Ceram and the small neighbouring islands of Kelang and Nila. So completely was the spice trade in their hands, that the crops of sixteen years were said to be at one time in their warehouses, those of recent years being never thrown on the market. Thus the crop of 1744 was being sold in 1760, in which year an immense quantity of nutmegs and cloves was burned at Amsterdam lest the price should fall too low.[9]

During the occupation of the Spice Islands by the English from 1796 to 1802, the culture of the nutmeg was introduced into Bencoolen

[1] *Les Prairies d'or*, i. (1861) 341.

[2] *Géographie*, trad. par Jaubert, i. (1836) 51.

[3] In the work quoted at p. 250, note 8.

[4] *Kosmographie*, übersetzt von Ethé, i. (1869) 227.

[5] *Carmen de motibus siculis*, Basil., 1746. 23.—A new édition of this work by Prof. Winklemann is now (1874) in the press.

[6] *Danske Lægebog*, quoted by Meyer, *Geschichte der Botanik*, iii. (1856) 537.

[7] Rogers, *Hist. of Agriculture and Prices in England*, i. (1866) 361–362. 623.—It is remarkable that *nutmegs* are not mentioned though *mace* is named repeatedly.

[8] Leber, *Appréciation de la fortune privée au moyen âge*, éd. 2, 1847. 95.

[9] Valmont de Bomare, *Dict. d'Hist. Nat.* iv. (1775) 297.—This author writes as an eye-witness of the destruction he has recorded:—"Le 10 Juin 1760, j'en ai vu à Amsterdam, près de l'Amirauté, un tas de l'aliment étoit estimé huit millions [illegible] de France: on devoit en brûler [illegible] le lendemain. Les pieds des spectateurs baignoient dans l'huile essentielle de ces substances . . ."

and Penang,[1] and many years afterwards into Singapore. Extensive plantations of nutmeg-trees were formed in the two islands last named, and by a laborious and costly system of cultivation were for many years highly productive.[2] In 1860, the trees were visited by a destructive blight which the cultivators were powerless to arrest, and which ultimately led to the ruin of the plantations, so that in 1867, there was no such thing as nutmeg cultivation either in Penang or Singapore.[3]

Though so long valued in Europe and Asia, neither nutmegs nor mace are ever employed as a condiment in the islands where they are indigenous.[4]

Collection and Preparation—Almost the whole surface of the Banda Isles, observes Mr. Wallace,[5] is planted with nutmeg-trees, which thrive under the shade of the lofty *Canarium commune*. The light volcanic soil, the shade, and the excessive moisture of these islands, where it rains more or less every month in the year, seem exactly to suit the nutmeg-tree, which requires no manure and scarcely any attention.

In Bencoolen,[6] the trees bear all the year round, but the chief harvest takes place in the later months of the year, and a smaller one in April, May and June. The fruit as it splits, is gathered by means of a hook attached to a long stick, the pericarp removed, and the mace carefully stripped off. The nuts are then taken to the drying house (a brick building), placed on frames, and exposed to the gentle heat of a smouldering fire, with arrangements for a proper circulation of air. This drying operation lasts for two months, during which time the nutmegs are turned every second or third day. At the end of this period, the kernels are found to rattle in the shell, an indication that the drying is complete. The shells are then broken with a wooden mallet, the nutmegs picked out and sorted, and finally rubbed over with dry sifted lime. In Banda the smaller and less sightly nutmegs are reserved for the preparation of the expressed oil.

The old commercial policy of the Dutch originated the singular practice of breaking the shell, and immersing the kernel of the artificially dried seed in milk of lime,—sometimes for a period of three months. This was done with a view to render impossible the germination of any nutmegs sent into the market. The folly of such a proceeding was demonstrated by Teijsmann, who proved that mere exposure to the sun for a week is sufficient to destroy the vitality of the seed. By immersion in milk of lime, many nutmegs are spoiled and the necessity is incurred of a second drying. Lumsdaine has also shown that even the *dry* liming process is, to say the least, entirely needless.

[1] How tempting the cultivation must have appeared, may be judged from the price of mace, which we find quoted on the January, 1806, in the *London Price Current* (which gives only *import prices*), as 85*s.* to 1*l.* per lb.;—to these rates must be added a duty of 7*s.* 1*d.* per lb.

[2] Seemann, *Hooker's Journ. of Bot.* iv. (1852) 83.

[3] Collingwood in *Journ. of Linnean Society*, Bot. x. (1869) 45.

[4] Crawfurd, *Dictionary of the Indian Islands*, 1856. 304.—Much additional information will be found in this work.

[5] *The Malay Archipelago*, i. (1869) 452.—See also Bickmore, *Travels in the East Indian Archipelago*, 1868. 225.

[6] Lumsdaine, *Pharm. Journ.* xi. (1852) 516. For further information on the management of nutmeg plantations in Sumatra, consult the original paper.

Nutmegs are well preserved in their natural shell, in which state the Chinese have the good sense to prefer them.

The process of liming nutmegs is however still largely followed; and the prejudice in favour of the spice thus prepared is so strong in certain countries, that nutmegs not limed abroad, have sometimes to be limed in London to fit them for exportation. Penang nutmegs are always imported in the natural state,—that is, *un-limed.*

Description—The fruit of *Myristica fragrans* is a pendulous, globose drupe, about 2 inches in diameter, and not unlike a small round pear. It is marked by a furrow which passes round it, and by which at maturity its thick fleshy pericarp splits into two pieces, exhibiting in its interior a single seed, enveloped in a fleshy foliaceous mantle or arillus, of fine crimson hue, which is *mace.* The dark brown, shining, ovate seed is marked with impressions corresponding to the lobes of the arillus; and on one side, which is of paler hue and slightly flattened, a line indicating the raphe may be observed.

The bony testa does not find its way into European commerce, the so-called *nutmeg* being merely the kernel or nucleus of the seed. Nutmegs exhibit nearly the form of their outer shell with a corresponding diminution in size. The London dealers esteem them in proportion to their size, the largest which are about one inch long by $\frac{8}{10}$ of an inch broad, and four of which will weigh an ounce, fetching the highest price. If not dressed with lime, they are of a greyish brown, smooth yet coarsely furrowed and veined longitudinally, marked on the flatter side with a shallow groove. A transverse section shows that the inner seed coat (*endopleura*) penetrates into the albumen in long, narrow brown strips, reaching the centre of the seed, thereby imparting the peculiar marbled appearance familiar in a cut nutmeg.

At the base of the albumen and close to the hilum, is the embryo, formed of a short radicle with cup-shaped cotyledons, whose slit and curled edges penetrate into the albumen. The tissue of the seed can be cut with equal facility in any direction. It is extremely oily, and has a delicious aromatic fragrance, with a spicy rather acrid taste.

Microscopic Structure—The testa consists mainly of long, thin, radially arranged, rigid cells, which are closely interlaced and do not exhibit any distinct cavities. The endopleura which forms the adhering coat of the kernel and penetrates into it, consists of soft-walled, red-brown tissue, with small scattered bundles of vessels. In the outer layers the endopleura exhibits small collapsed cells; but the tissue which fills the folds that dip into the interior, consists of much larger cells. The tissue of the albumen is formed of soft-walled parenchyma, which is densely filled with conspicuous starch-grains, and with fat, partly crystallized. Among the prismatic crystals of fat, large thick rhombic or six-sided tables may often be observed. With these are associated grains of albuminoid matter.

Chemical Composition—After starch and albuminoid matter, the principal constituent of nutmeg is the *fat*, which makes up about a fourth of its weight, and is known in commerce by the incorrect name of *Oil of Mace* (see p. 456).

The volatile oil, to which the smell and taste of nutmegs are chiefly

amounts to between 2 and 3 per cent.,[1] and consists, according to (1864), almost entirely of a hydrocarbon, $C^{10}H^{16}$, boiling at 165° C., ı Gladstone [2] who assigns it the same composition, calls *Myristicene.* atter chemist found in the crude oil, an oxygenated oil, *Myristicol,* ry difficult purification and possibly subject to change during the ss of rectifying. It has a high boiling point (about 220° C. ?) and haracteristic odour of nutmeg; unlike carvol and menthol with ı it is isomeric, it does not form a crystalline compound with sulphuric acid.

il of nutmegs, distilled in London by Messrs. Herrings and Co., ined in a column 200 mm. long, we found to deviate the ray of ized light, 15°·3 to the right; that of the Long Nutmeg (*Myristica* Houtt.), furnished to us by the same firm, deviated 28°·7 to the right. rom the facts recorded by Gmelin,[3] it would appear that oil of eg sometimes deposits a stearoptene called *Myristicin.* We are not ainted with such a deposit; yet we have been kindly furnished by rs. Herrings with a crystalline substance which they obtained during atter part of the process of distilling both common and long egs. It is a greyish greasy mass, which by repeated crystallizations spirit of wine, we obtained in the form of brilliant, colourless , fusible at 54° C., and still possessing the odour of nutmeg. The ıls are readily soluble in benzol, bisulphide of carbon or chloro- sparingly in petroleum ether; their solution in spirit of wine ı decidedly acid reaction, and is devoid of rotatory power. By ıg them with alcohol, sp. gr. 0·843, and anhydrous carbonate of ın, we obtained a solution which after removal of the alcohol, left a ıum perfectly soluble in boiling water, forming a jelly on cooling. lding hydrochloric acid to the warm aqueous solution, the original llizable substance again made its appearance, yet almost devoid of . It is in fact nothing else than *Myristic Acid* (see next page).

roduction and Commerce—The nutmegs and mace now brought he market are to a large extent the produce of the Banda Islands,[4] ıich however only three, namely Lontar or the Great Banda, Pulo ıd Pulo Nera, have what are termed *Nutmeg Parks.* According to l statements of the Dutch, the first-named island possessed in about 266,000 fruit-bearing trees; Ternate on the western coast of , 46,000; Menado in the island of Celebes, 35,000, and Amboyna, 31,000. The nutmegs of the Banda Islands are shipped to Batavia. uantity exported from Java in 1871 (all, we believe, from Batavia, herefore the produce of the Banda Islands) is stated as 8107 peculs),933 lb.), of which 2300 peculs (306,666 lb.) were shipped to the d States, and a rather larger quantity to Singapore.[5] The last- d port also shipped in the same year a very large quantity 576 lb.) of nutmegs to North America.[6]

ssrs. Herrings & Co. of London have ed us, that 2874 lb. of nutmegs dis- n their laboratory, afforded 67 lb. of l oil, *i.e.* 2·33 per cent.

rn. *of Chemical Soc.* x. (1872) i.

emistry, xiv. (1860) 389.

ne idea of the extremely small area e famous islands may be gathered from the fact that the Great Banda, the largest of them, is but about 7 miles long by 2 miles broad; while the entire group occupies no more than 17·6 geographical square miles.

[5] *Consular Reports*, August 1873. 952 3.

[6] *Blue Book for the Colony of the Straits Settlements for* 1871, Singapore, 1872.

Nutmegs were exported from Padang in Sumatra in the year 1871, to the extent of 2766 peculs (368,800 ℔.), chiefly to America and Singapore. The quantity imported into the United Kingdom in 1870, was 537,978 ℔.

Uses—Nutmeg is a grateful aromatic stimulant, chiefly employed for flavouring other medicines. It is also in constant use as a condiment, though less appreciated than formerly.

Oleum Myristicæ expressum.

Oleum Macidis; Balsamum vel Oleum Nucistæ; Expressed Oil of Nutmegs, Nutmeg Butter, Oil of Mace; F. *Beurre de Muscade;* G. *Muskatbutter, Muskatnussöl.*

This article reaches England chiefly from Singapore, in oblong, rectangular blocks, about 10 inches long by 2½ inches square, enveloped in a wrapper of palm leaves. It is a solid unctuous substance of an orange-brown colour, varying in intensity of shade, and presenting a mottled aspect. It has a very agreeable odour and a fatty aromatic taste.

In operating on 2 ℔. of nutmegs, first powdered and heated in a waterbath and pressed while still hot, we obtained 9 ounces of solid oil, equivalent to 28 per cent. This oil, which in colour, odour and consistence does not differ from that which is imported, melts at about 45° C.; and dissolves perfectly in two parts of warm ether or in four of warm alcohol sp. gr. ·800.

Nutmeg butter contains the volatile oil already described, to the extent of about 6 per cent., besides several fatty bodies. One of the latter, termed *Myristin*, $C^{45}H^{86}O^{6}$, may be obtained by means of benzol, or by dissolving in ether that part of the butter of nutmeg which is insoluble in cold spirit of wine. The crystals of myristin melt, according to Playfair (1841), at 31° C. By saponification, they furnish glycerin, and *Myristic Acid*, $C^{14}H^{28}O^{2}$, the latter fusing at 53°·8 C.[1] Myristin also occurs in spermaceti as well as, according to Mulder, in small quantity, in the fixed oils of linseed and poppy seed. Nutmegs according to Comar (1859) yield 10 to 12 per cent. of myristin.

That part of nutmeg butter, which is more readily soluble in spirit of wine or benzol, contains another fat, which however has not yet been investigated. It is accompanied by a reddish colouring matter.

MACIS.

Mace; F. *Macis;* G. *Macis, Muskatblüthe.*

Botanical Origin—*Myristica fragrans* Houttuyn (see p. 451). The seed which deprived of its hard outer shell or testa, is known as the *nutmeg*, is enclosed when fresh in a fleshy net-like envelope, somewhat resembling the husk of a filbert. This organ which is united though not very closely, at the base of the stony shell both with the hilum and the contiguous portion of the raphe, of which parts it is an expansion, is termed *arillus*,[2] and when separated and dried, constitutes the mace of

[1] Gmelin, *Chemistry*, xvi. (1864) 209.

[2] On the nature and origin of this organ, see Baillon, *Hist. des Plantes*, ii. (1870) 499.

he shops. In the fresh state it is fleshy, and of a beautiful crimson; it nvelopes the seed completely only at the base, afterwards dividing helf into broad flat lobes, which branch into narrower strips overlapping ne another towards the summit.

History—Included in that of the nutmeg (see preceding article).

Description—The mace separated from the seed by hand, is dried n the sun, thereby losing its brilliant red hue and acquiring an orange-rown colour. It has a dull fatty lustre, exudes oil when pressed with he nail, and is horny, brittle and translucent. Steeped in water it rwells rather considerably. The entire arillus compressed and crumpled y packing, is about $1\frac{3}{4}$ inches long with a general thickness of about $\frac{1}{8}$ of an inch or even $\frac{1}{10}$ at the base. Mace has an agreeable aromatic mell nearly resembling that of nutmeg, and a pungent, spicy, rather erid taste.

Microscopic Structure—The uniform, small-celled, angular parenhyme, is interrupted by numerous brown oil-cells of larger size. The nner part of the tissue contains also thin brown vascular bundles. he cells of the epidermis on either side are colourless, thick-walled, ngitudinally extended, and covered with a peculiar cuticle of broad, at, riband-like cells, which cannot however be removed as a continuous lm. The parenchyme is loaded with small granules, to which a red olour is imparted by Millon's test (solution of mercurous nitrate) and n orange hue by iodine. The granules consequently consist of albuminous matter, and starch is altogether wanting.

Chemical Composition—The nature of the chemical constituents f mace may be inferred from the following experiments performed by me of us:—17 grammes of finely powdered mace were entirely exhausted by boiling ether, and the latter allowed to evaporate. It left hind 5·57 grm., which after drying at 100° C. were diminished to 4·17. he difference, 1·40 grammes, answers to the amount of *essential oil*, of hich consequently 8·2 per cent. had been present.

The residue, amounting to 24·5 per cent., was a thickish aromatic lsam, in which we have not been able to ascertain the presence of *fat*; consisted of resin and semi-resinified essential oil. Alcohol further reoved 1·4 per cent. of an uncrystallizable sugar, which reduced cupric oxide.

The drug having been thus treated with ether and with alcohol, elded almost nothing to cold water, but by means of boiling water 3 per cent. of a mucilage was obtained, which turned blue by addition iodine, or reddish violet if previously dried. This substance is not uble in an ammoniacal solution of cupric oxide; it appears rather to an intermediate body between mucilage and starch.[1] The composition mace is therefore very different from that of nutmeg.

As to the *volatile oil*, of which several observers have obtained from o 9 per cent.,[2] it is a fragrant colourless liquid which we found, when amined in a column 200 mm. long, deviated the ray 18°·8 to the right. greater portion consists according to Schacht (1862) of *Macene*, $^{2}H^{16}$, a hydrocarbon boiling at 160° C., and distinguished from oil of

[1] See my paper: *Ueber Stärke und Cellulose Archiv der Pharm.* 196 (1871) 31.—A. F.

[2] In an actual experiment (1868) in the laboratory of Messrs. Herrings & Co., London, 23 lb. of mace yielded 23 ozs. of volatile oil, which is equivalent to 6¼ per cent.

turpentine by not forming a crystalline hydrate when mixed with alc and nitric acid. Koller (1865) states that macene is identical with hydrocarbon of oil of nutmeg (myristicene), yet the latter is said Cloëz to yield no solid compound when treated with hydrochloric Macene on the other hand furnishes crystals of $C^{10}H^{16},HCl$. Crud of mace contains like that of nutmeg, an oxygenated oil, the prope of which appear to have been not yet investigated.

Commerce—Mace, mostly the produce as it would appear of Banda Islands, was shipped from Java in 1871, to the extent of 2 peculs (282,133 lb.); and from Padang in Sumatra (excluding shipm to Java) to the amount of 457 peculs (60,933 lb.).[1] The spice is expo principally to Holland, Singapore, and the United States.

Uses—Mace is but rarely employed in medicine. It is chiefly c sumed as a condiment.

LAURACEÆ.

CAMPHORA.

Camphor,[2] *Common Camphor, Laurel Camphor;* F. *Camphre;* G. *Campher.*

Botanical Origin—*Cinnamomum Camphora* Fr. Nees et Eberm (*Laurus Camphora* L., *Camphora officinarum* C. Bauh.), the Camp tree or Camphor Laurel, is widely diffused, being found through Central China and in the Japanese Islands. In China, it abou principally in the eastern and central provinces, as in Chekiang, Fok and Kiangsi. It is likewise plentiful in the island of Formosa, when covers the whole line of mountains from north to south, up to an ele tion of 2000 feet above the level of the sea. It flourishes in trop and subtropical countries, and forms a large and handsome tree sheltered spots in Italy as far north as the Lago Maggiore. The lea are small, shining, and glaucous beneath, and have long petioles; stem affords excellent timber, much prized on account of its odour making clothes' chests and the drawers of cabinets.

Camphor is obtained from other plants besides the camphor lau the most remarkable being *Dryobalanops aromatica*, a noble tree of Indian Archipelago, further described at p. 464.

History—The two kinds of camphor afforded by the two trees named, have always been regarded by the Chinese as perfectly disti substances, and in considering the history of camphor this fact must borne in mind.

On perusing the accounts of Laurel Camphor given by Chi writers,[3] the remarkable fact becomes apparent, that although the was evidently well known in the 6th century, and probably even ear

[1] *Consular Reports*, August 1873. 952-3.

[2] The word *Camphor*, generally written by old Latin authors *Caphura*, and by English *Camphire*, is derived from the Arabic *Káfúr*, which in turn is supposed to come from the Sanskrit *Karpura*, signifying *white*.

[3] Passages from several have be n lated and kindly placed at our dispo Mr. A. Wylie. Dr. Bretschneider of P has also been good enough to aid us in same manner.

cially noticed on account of its valuable timber, no mention
connexion with it of any such substance as *camphor.*
-chin, the author of the celebrated herbal *Pun-tsao-kang-muh,*
the middle of the 16th century, was well acquainted with the
of camphor,—the one produced by the camphor laurel of his
try, the other imported from the Malay islands; and he
ow the former was prepared by boiling the wood, and refined
d dry sublimations.

Polo, towards the end of the 13th century, saw the forests of
South-eastern China, in which, says he, are many of the trees
camphor.[1] It would thus appear that Laurel Camphor was
early as the time of Marco Polo, yet it is certain that the
ent notices which we shall now quote, have reference to the
ed Malay Camphor, which remains up to the present day one
st precious substances of its class.

is no evidence that camphor reached Europe during the
eriod of Greece and Rome. The first mention of it known to
in one of the most ancient monuments of the Arabic lan-
poems of Imru-l-Kais,[2] a prince of the Kindah dynasty, who
Hadramaut in the beginning of the 6th century. Nearly at
period, Aëtius of Amida (the modern Diarbekir) used camphor
ly, but from the manner in which he speaks of it, it was
a substance of some rarity.[3]

t for many centuries subsequent to this period, camphor was
s one of the most rare and precious of perfumes. Thus, it is
in A.D. 636, with musk, ambergris, and sandal wood, among
ires of Chosroes II., of the Sassanian dynasty of kings of
the palace at Madain on the Tigris, north of Babylon.[4]

the immense mass of valuables dispersed at Cairo on the
of the Fatimite Khalif Mostanser in the 11th century, the
Camphor of Kaisur, and the figures of *melons in camphor*
ith gold and jewels, besides vast quantities of musk and aloes
noticed with astonishment by Arabian historians.[5] It is
ecord that about A.D. 642, Indian princes sent camphor as
a gift to the Chinese Emperors;[6]—further, that in the Teen-
d (A.D. 742–755), the Cochinchinese brought to the Chinese
bute of Barus camphor said by the envoy to be found in the
old trees, the like of which for fragrance was never seen
Masudi,[8] four centuries later, mentions a similar present from
to a Chinese potentate, when 1000 *menn*[9] of aloes wood were
ied by 10 *menn* of camphor, the choice quality of the latter
icated by the remark that it was in pieces as large or larger
tachio-nut.

ok of Sir Marco Polo, ii. (1871)

description of Arabia by Ibn
amdany, fol. 170 of the MS. at
Sprenger).

cts two ounces of camphor to
a certain preparation, provided
sufficiently abundant.—Tetr. iv.
114.

il, *Geschichte der Chalifen,* i.
1846) 75.

[5] Quatremère, *Mém. sur l'Egypte,* ii. (1811)
366–375.—It is interesting to find that *Kâfûre-kaisûri,* i.e. *Kaisur Camphor* is a term
still known in the Indian bazaars.

[6] Käuffer, *Geschichte von Ostasien,* ii. (1859)
491.

[7] Translation from the Chinese communi-
cated by Mr. A. Wylie.

[8] *Les Prairies d'or,* i. (Paris, 1861) 200.

[9] The Arabian *mend* or *mean* is equal to
2½ pounds Troy.

Again, between A.D. 1342 and 1352, an embassy left Pekin b a letter from the Great Khan to Pope Benedict XII., accompani presents of silk, precious stones, *camphor*, musk, and spices.[1]

Ibn Batuta, the celebrated traveller, relates that after having the King of Sumatra, he was presented on leaving (A.D. 1347) aloes-wood, *camphor*, cloves, and sandal-wood, besides provisions.

Ishâk ibn Amrân, an Arabian physician living towards the the 9th century, and Ibn Khurdádbah, a geographer of the same were among the first to point out that camphor is an export Malayan Archipelago; and their statements are repeated by the A writers of the middle ages, who all assert that the best camp produced in Fansúr. This place, also called Kansúr or Kaisú visited in the 13th century by Marco Polo, who speaks of its ca as selling for its weight in gold; Yule[2] believes it to be the sam as Barus, a town on the western coast of Sumatra, still giving a to the camphor produced in that island.

From all these facts and many others that might be adduc undoubtedly follows that the camphor first in use was that found in the trunk of the Sumatran *Dryobalanops aromatica*, and not tl the Camphor Laurel. At what period and at whose instigatio Chinese began to manufacture camphor from the latter tree, a known.

Camphor was known in Europe as a medicine as early as the century, as is evident from the mention of it by the abbess Hilde (who calls it *ganphora*), Otho of Cremona,[5] and the Danish Harpestreng (*ob.* A.D. 1244).

Garcia d'Orta states (1563) that it is the camphor of China alone is exported to Europe, that of Borneo and Sumatra be hundred times more costly, and all consumed by eastern na Kämpfer,[6] who resided in Japan in 1690–92, and who figure Japanese camphor tree under the name *Laurus camphorifera*, exp declares the latter to be entirely different from the camphor tree Indian Archipelago. He further states that the camphor of Borne among the more profitable commodities imported into Japan b Dutch, whose homeward cargoes included Japanese camphor t extent of 6000 to 12,000 lb. annually.[7] This camphor was refin Holland by a process long kept secret, and was then introduced in market. In Pomet's time (1694 and earlier), crude camphor common in France, but it had to be sent to Holland for purification

It is doubtful whether at that period, or even much later, camphor was obtained from Formosa. Du Halde[8] makes no allusi it as a production of that island; nor does he mention it amon commodities of Emouy (Amoy), which was the Chinese port th most active communication with Formosa.

Production—The camphor of European commerce is produc

[1] Yule, *Cathay and the way thither*, ii. 357.

[2] *The Book of Ser Marco Polo*, ii. 244.

[3] For further historical details, compare my paper in the *Schweizerische Wochenschrift f. Pharmacie*, 27 Sept., 4 and 11 Oct. 1867, and in Buchner's *Repertorium f. Pharmacie* xvii (1868) 28.—F. A. F.

[4] S. Hildegardis *Opera Omnia*, ac J. P. Migne, Paris, 1855. 1145.

[5] Choulant, *Macer Floridus*, Lips. 161.

[6] *Amœnitates exoticæ* (1712) 770.

[7] *Hist. of Japan*, translated by Scheu i. (1727) 353. 370.

[8] *Description de la Chine*, i. (1735)

island of Formosa and in Japan. We have no evidence that any is nufactured at the present day in China.

In Formosa, the camphor-producing districts lie in the narrow belt debateable ground, which separates the border Chinese settlements m the territory still occupied by the aboriginal tribes. The camphor prepared from the wood, which is cut into small chips from the trees, means of a gouge with a long handle. In this process there is at waste, many trees being cut and then left with a large portion valuable timber to perish. The next operation is to expose the od to the vapour of boiling water, and to collect the camphor which atilizes with the steam. For this purpose, stills are constructed thus: a long wooden trough, frequently a hollowed trunk, is fixed over a nace and protected by a coating of clay. Water is poured into it, d a board perforated with numerous small holes is luted over it. ove these holes, the chips are placed and covered with earthen pots. fire having been lighted in the furnace, the water becomes heated, and steam passing through the chips, carries with it the camphor, which ndenses in minute white crystals in the upper part of the pots. From se it is scraped out every few days, and is then very pure and clean. ur stills, each having ten pots placed in a row over one trough, are nerally arranged under one shed. These stills are moved from time to e, according as the gradual exhaustion of timber in the locality ders such transfer desirable. A considerable quantity of camphor is wever manufactured in the towns, the chips being conveyed thither m the country.

Camphor is brought from the interior to Tamsui, the chief port of rmosa, in baskets holding about half a pecul each (1 pecul = 133⅓ lb.), ed and covered with large leaves. Upon arrival, it is stored in vats ding from 50 to 60 peculs each, or it is packed at once in the tubs, lead-lined boxes, in which it is exported. From the vats or tubs, re drains out a yellowish essential oil known as *Camphor Oil*, which sed by the Chinese in rheumatism.[1]

Kämpfer in his account[2] of the manufacture of camphor in the panese province of Satzuma and in the islands of Gotho, describes the ling of the chips in an iron pot covered with an earthen head taining straw in which the camphor collects. He does not mention draining of the product from essential oil.

Purification—Camphor as it arrives in Europe requires to be purified sublimation. The crude drug consists of small crystalline grains, ich cohere into irregular friable masses, of a greyish white or pinkish e. Dissolved in spirit of wine, it leaves from 2 to 10 per cent. of impuies consisting of gypsum, common salt, sulphur, or vegetable fragments.

In Europe, crude camphor is sublimed from a little charcoal or sand, n filings or quick-lime, and sent into the market as *Refined Camphor* the form of large bowls or concave cakes, about 10 inches in diameter, nches in thickness, and weighing from 9 to 12 lb.[3] Each bowl has a

The foregoing particulars are chiefly acted from the *Trade Report of Tamsui* E. C. Taintor, Acting Commissioner of tsma, published in the *Reports on Trade the Treaty Ports in China* for 1869, nghai, 1870.

[2] *Op. cit.* p. 772.

[3] These are the dimensions of the cakes manufactured in the laboratory of Messrs. Howards of Stratford, but it is obvious that they may vary with different makers.

large round hole at the bottom, corresponding to the aperture of t vessel in which the sublimation has been conducted. This operation performed in peculiar glass flasks termed *bomboloes*, in the upper half which the pure camphor concretes. These flasks having been charg and placed in a sand-bath, are rapidly heated to about 120°–190° C. order to remove the water. Afterwards the temperature is slowly creased to about 204° C., and maintained during 24 hours. The fla are finally broken.

As camphor is a neutral substance, the addition of lime probal serves merely to retain traces of resin or empyreumatic oil. It would keep back sulphur were any present.

The refining of camphor is carried on to a large extent in Engla Holland, Hamburg, and Paris. It is a process requiring great care account of the inflammability of the product. The temperature m also be nicely regulated, so that the sublimate may be deposited n merely in loose crystals, but in compact cakes. In India where the co sumption of camphor is very large, the natives effect the sublimation a copper vessel, the charge of which is 1½ maunds (42 lb.): fire applied to the lower part, the upper being kept cool.[1]

Description — Purified Camphor forms a colourless crystallin translucent mass, traversed by numerous fissures, so that notwithstan ing a certain toughness, a mass can readily be broken by repeated blow By spontaneous and extremely slow evaporation at ordinary temper tures, camphor sublimes in lustrous hexagonal plates or prisms, havi but little hardness. If triturated in a mortar, camphor adheres to t pestle, so that it cannot be powdered *per se*. But if moistened wi spirit of wine, ether, chloroform, methylic alcohol, glycerin, or essential or fatty oil, pulverization is effected without difficulty. keeping a short time, the powder acquires a crystalline form. With equal weight of sugar, camphor may also be easily powdered.

Camphor melts at 175° C., boils at 205° C., and volatilizes somew rapidly even at ordinary temperatures. To this latter property, c bined with slight solubility, must be attributed the curious rotat motion which small lumps of camphor (as well as barium butyr stannic bromide, and a few other substances) exhibit when thrown to water.

The solubility of camphor in water is very small, 1300 parts diss ing about one; but even this small quantity is partially separated addition of some alkaline or earthy salt, as sulphate of magnes Alcohols, ethers, chloroform, carbon bisulphide, volatile and fixed and liquid hydrocarbons, dissolve camphor abundantly.

The sp. gr. of camphor at 0° C. and up to 6° C. is the same as th water; yet at a somewhat higher temperature, camphor expands quickly, so that at 10° to 12° C. its sp. gr. is only 0·992.

In concentrated solution or in a state of fusion, camphor turns plane of polarization strongly to the right. Officinal solution of cam (*Spiritus Camphoræ*) is too weak, and does not deviate the ray of to a considerable amount.[2] Crystals of camphor are devoid of rota power.[3]

[1] Mattheson, *England to Delhi*, Lond. 1870. 474.

[2] *Pharm. Journ.* 18 April, 1874. 830.

[3] Des Cloizeaux, *Comptes Rendus*, (1870) 1209.

The taste and odour of camphor are *sui generis*, or at least are com- only to a group of nearly allied substances. Camphor is not ed by exposure to air or light. It burns easily, affording a brilliant ty flame.

Chemical Composition—Camphor, $C^{10}H^{16}O$, by treatment with ous reagents, yields a number of interesting products: thus when ated distilled with chloride of zinc or anhydrous phosphoric acid, converted into *Cymol*, $C^{10}H^{14}$, a body contained in many essential or obtainable therefrom.

Camphor, and also camphor oil, when subjected to powerful oxidizing ts, absorbs oxygen, passing gradually first into crystallized *Cam- ic Acid*, $C^{10}H^{16}O^4$, and afterwards into *Camphretic Acid*,[1] $C^{10}H^{14}O^7$, r and carbonic acid being at the same time eliminated. Many ntial oils, resins and gum-resins likewise yield these acids when larly treated.

By means of less energetic oxidizers, camphor may be converted into *camphor*, $C^{10}H^{16}O^2$, still retaining its original odour and taste eeler, 1868).[2]

Commerce—Two kinds of crude camphor are known in the English ket, namely:

1. *Formosa* or *China Camphor*, imported in chests lined with lead nned iron, and weighing about 1 cwt. each; it is of a light brown, ll in grain, and always wet, as the merchants cause water to be ed into the cases before shipment, with a view, it is pretended, of ning the loss by evaporation. The exports of this camphor from sui in Formosa[3] in the years 1870–71–72 were as follows:—

1870	1871	1872
461 peculs (1,930,800 lb.)	9691 peculs (1,292,133 lb.)	10,281 peculs (1,370,800 lb.)

The shipments of camphor from Takow, the other open port of mosa, are of insignificant amount. Planks of camphor wood are r exported in some quantity from Tamsui.

2. *Japan Camphor* is lighter in colour and occasionally of a pinkish ; it is also in larger grains. It arrives in double tubs (one within other) without metal lining, and hence is drier than the previous ; the tubs hold about 1 cwt. It fetches a somewhat higher price n the Formosa camphor.

Hiogo and Osaka exported in 1871, 7089 peculs (945,200 lb.), and saki 745 peculs (99,333 lb.), the total value being 116,718 dollars.[4] imports of *Unrefined Camphor* into the United Kingdom amounted 1870 to 12,368 cwt. (1,385,216 lb.); of *Refined Camphor* in the same r to 2361 cwt.[5]

Schwanert in *Liebig's Annalen*, 128 77.—Kachler (1871) has disputed the nce of this acid.

For information respecting the numerous compounds of camphor, consult Gmelin, istry, xiv. (1860) 338; Watts, *Dict. of istry*, i. (1863); Schorlemmer, *Carbon pounds*, 1874. 303.

[3] *Returns of Trade at the Treaty Ports in China for* 1872, part. 2. p. 124.

[4] *Commercial Reports from H. M. Consuls in Japan*, No. 1, 1872.—The returns for Hiogo and Osaka are upon the authority of the Chamber of Commerce.

[5] *Statement of the Trade and Navigation of the United Kingdom* for 1870. p. 61—no later returns accessible.

Camphor is largely consumed by the natives of India; the qu of the crude drug imported into Bombay in the year 1872-73, 3801 cwt.[1]

Uses—Camphor has stimulant properties and is frequently us medicine both internally and externally. It is largely consumed in

Other kinds of Camphor; Camphor Oils.

Barus Camphor, Borneo Camphor, Malayan Camphor, balanops Camphor.—This, as already explained, is the substa which the earliest notices of camphor refer. The tree which a it is *Dryobalanops aromatica* Gärtn. (*D. Camphora* Colebrooke), order *Dipterocarpeæ*, one of the most majestic objects of the veg kingdom. The trunk is very tall, round, and straight, furnished the base with huge buttresses; it rises 100 to 150 feet without a b then producing a dense crown of shining foliage, 50 to 70 feet i meter, on which are scattered beautiful white flowers of del fragrance.[2] The tree is indigenous to the Dutch Residencies o north-west coast of Sumatra, between 0° and 3° N. lat., from Bangis to Barus and Singkel, and to the northern part of Borne the small British island of Labuan.

The camphor is obtained from the trunk, in longitudinal fi of which it is found in a solid crystalline state, and extracte laboriously splitting the wood. It can only be got by the de tion of the entire tree; — in fact, many trees afford none, so to avoid the toil of useless felling, it is now customary to try by cutting a hole in the side of the trunk, but the observati made is often fallacious. Spenser St. John, British Consul in B was told that trees in a state of decay often contain the finest phor.[3] The camphor when collected is carefully picked over, v and cleaned, and then separated into three qualities, the best formed of the largest and purest crystals, while the lowest is g and pulverulent.

It is difficult to state how much camphor is usually obtained single tree, but Colebrooke's statement that a tree should produc 11 lb. is, we suspect, near the truth.[4]

A good proportion of the small quantity produced is consu the funeral rites of the Batta princes, whose families are often by the lavish expense of providing the camphor and buffaloes the custom of their obsequies requires. The camphor which is e is eagerly bought for the China market, but some is also sent to Laos, Cochin China, Cambodia, and Siam.

[1] *Statement of the Trade and Navigation of Bombay for* 1872-73. ii. 27.

[2] For some recent observations on the botany of *Dryobalanops*, see paper by W. T. Thiselton Dyer in Trimen's *Journ. of Botany*, April 1874. 98.

[3] *Life in the Forests of the Far East*, ii. (1862) 272.

[4] De Vriese and Motley in Hooker's *Journ. of Bot.* iv. (1852) 33. 202. De Vriese declares this to be quite exaggerated, and that the thickest and oldest trees rarely co than 2 ounces! If the latter state true, it would require at least le yield a single pecul of camphor. Mi *Flora Sumatranæ*, 66.) confirms C in stating that 100 lb. was said produce of 9 trees. Another re he quotes, is to the effect that a s yields only a few catties (1 catty = 604 grammes).

uantity annually shipped from Borneo was reckoned by Motley
be about 7 peculs (933 lb.). The export from Sumatra was
by De Vriese at 10 to 15 quintals per annum.[1] The quantity
into Canton in 1872 was returned as $23\frac{7}{10}$ peculs (3159 lb.),
26 taels, equivalent to about 80*s.* per lb.[2] In the *Annual*
of the Trade of Bombay for the year 1872-3, 2 cwt. of *Malayan*
is stated to have been imported; it was valued at 9141 Rs.
The price in Borneo in 1851 of camphor of fine quality, was
per catty, or about 95*s.* per lb.: consequently the drug never
ay into European commerce.

Camphor, also termed by chemists *Borneol* or *Camphyl Alcohol*,
at harder than common camphor, also a little heavier so that
water. It is less volatile, and does not crystallize on the
the bottle in which it is kept; and it requires for fusion a
perature, namely 198° C. It has a somewhat different odour,
that of common camphor with the addition of patchouli or
The composition of borneol is represented by the formula
It may be converted by the action of nitric acid into common
which it nearly resembles in most of its physical properties.
, as Berthelot (1858) has shown, borneol[3] may be prepared
non camphor by heating the latter with alcoholic potash; or,
to Baubigny (1866) by treating a solution of camphor in
sodium.

hor Oil of Borneo—Besides camphor, the *Dryobalanops*
another product, a liquid termed *Camphor Oil*, which must
founded with the camphor oil that drains out of crude laurel
This Borneau or Sumatran *Camphor Oil* is obtained by
e trees, or in felling them (see also p. 202). In the latter way,
cutting down a tree in Labuan in May 1851, pierced a reser-
e trunk from which about five gallons of camphor oil were
hough much could not be caught.[4] The liquid was a volatile
in solution a resin, which after a few days' exposure to the
ft in a syrupy state. This camphor oil, which is termed *Bor-*
someric with oil of turpentine, $C^{10}H^{16}$, yet in the crude state,
solution borneol and resin. By fractional distillation, it may
ed into two portions, the one more volatile than the other but
ng in composition.

hor Oil of Formosa, which has been already referred to as
out of the crude camphor of *Cinnamomum Camphora*, is a
uid holding in solution an abundance of common camphor,
peedily deposits in crystals when the temperature is slightly
From Borneo Camphor Oil, it may be distinguished by its
assafras. We find no optical difference in the rotatory power
; both are dextrogyre to the same extent, which is still the
e camphor from the lauraceous camphor oil is separated by

rn's time (*Oriental Commerce*, ii.
umatra was reckoned to export
nd Borneo 30 peculs a year.
tement that China imports of
or about 800 peculs annually is
eous.

[2] *Returns of Trade at the Treaty Ports in China for* 1872, p. 30.

[3] More correctly a substance of the same composition yet differing in optical power, and therefore termed *Camphol*.

[4] Ibn Khurdádbah in the 9th century, mentions it as being obtained in this way.

cooling. Borneo camphor oil, for a sample of which we are indebted t Prof. de Vriese, deposits no camphor even when kept at – 15° C.

Ngai Camphor, Blumea Camphor—It has been known for man years that the Chinese are in the habit of using a third variety camphor, having a pecuniary value intermediate between that of comm camphor and of Borneo camphor. It has been lately shown (1874) th this substance is manufactured at Canton, the plant from which it obtained being *Blumea balsamifera* DC., a tall herbaceous *Compos* called in Chinese *Ngai*, abundant in Tropical Eastern Asia.

The drug has been supplied to us [1] in two forms,—crude and pure,- the first being in crystalline grains of a dirty white, contaminated wit vegetable remains; the second in colourless crystals as much as an inc in length. By sublimation, the substance may be obtained in distinc brilliant crystals, agreeing precisely with those of Borneo camph which they also resemble in odour and hardness, as well as in being little heavier than water and not so volatile as common camphor.

The chemical examination of Ngai camphor, performed by Plowman under the direction of Prof. Attfield, has proved that it has the compos tion $C^{10}H^{18}O$, like Borneo camphor. But the two substances differ i optical properties,[3] an alcoholic solution of Ngai camphor being *levogy* in about the same degree that one of Borneo camphor is *dextrogyre*. B boiling nitric acid, Borneo camphor is transformed into comm (*dextrogyre*) camphor, whereas Ngai camphor affords a similar yet *levogy* camphor, in all probability identical with the stearoptene of *Chrysan themum Parthenium* Pers.

As Ngai camphor is about ten times the price of Formosa camph it never finds its way to Europe as an article of trade. In China, it consumed partly in medicine and partly in perfuming the fine kinds Chinese ink. The export of this camphor by sea from Canton, is valu at about £3,000 a year.

CORTEX CINNAMOMI.

Cortex Cinnamomi Zeylanici; Cinnamon; F. *Cannelle de Ceylan*; G. *Zimmt, Ceylon Zimmt, Kanel.*

Botanical Origin—*Cinnamomum Zeylanicum* Breyne,—a sm evergreen tree, richly clothed with beautiful, shining leaves usually sa what glaucous beneath, and having panicles of greenish flowers of agreeable odour.

It is a native of Ceylon, where, according to Thwaites, it is ge rally distributed through the forests up to an elevation of 3000 and one variety even to 8000 feet. It is exceedingly variable stature, and in the outline, size and consistence of the leaf; and sev of the extreme forms are very unlike one another and have rece specific names. But there are also numerous intermediate forms; an a large suite of specimens, many occur of which it is impossible determine whether they should be referred to this species or to t

[1] Through the courtesy of Mr. F. H. Ewer, of the Imperial Maritime Customs, Canton.

[2] *Pharm. Journ.*, March 7, 1874. 71

[3] Flückiger in *Pharm. Journ.*, Apri 1874. 829.

s[1] is of opinion that some still admitted species, as *C. obtusi-* Nees and *C. iners* Reinw., will prove on further investigation to be ms of *C. Zeylanicum.*

lome,[2] Conservator of Forests in Madras, remarks that in the orests of South-western India, there are 7 or 8 well-marked which might easily be regarded as so many distinct species, but fact that they are so connected *inter se* by intermediate forms, s impossible to find constant characters worthy of specific dis- They grow from the sea level up to the highest elevations and, ome thinks, owe their differences chiefly to local circumstances, ie is disposed to class them simply as forms of *C. Zeylanicum.*

:ory—Cinnamon was held in high esteem in the most remote history. In the words of the learned Dr. Vincent, Dean of ister,[3] it seems to have been the first spice sought after in all voyages. Both cinnamon and cassia are mentioned as precious ous substances in the Mosaic writings and in the Biblical books is, Proverbs, Canticles, Ezekiel and Revelations, also by Theo-, Herodotus, Galen, Dioscorides, Pliny, Strabo and many other of antiquity: and from the accounts which have thus come us, there appears reason for believing that the spices referred nearly the same as those of the present day. That cinnamon ia were extremely analogous, is proved by the remark of Galen, finest cassia differs so little from the lowest quality of cinnamon, first may be substituted for the second, provided a double weight used.

also evident that both were regarded as among the most costly tics, for the offering made by Seleucus II., king of Syria, and her Antiochus Hierax, to the temple of Apollo at Miletus, -227, consisting chiefly of vessels of gold and silver, included pounds of *Cassia* (*κασία*), and the same quantity of *Cinnamon* *μον*).[4]

onnexion with this subject there is one remarkable fact to be which is that none of the cinnamon of the ancients was obtained ylon. "In the pages of no author," says Tennent,[5] "European c, from the earliest ages to the close of the thirteenth century, the remotest allusion to cinnamon as an indigenous production, is an article of commerce in Ceylon." Nor do the annals of the between whom and the inhabitants of Ceylon from the 4th to centuries, there was frequent intercourse and exchange of ities, name *Cinnamon* as one of the productions of the island. ed Books and other ancient records of the Singhalese are also ly silent on this point.

a under the name of *Kwei*, is mentioned in the earliest Chinese -that of the emperor Shen-nung, who reigned about 2700 B.C., icient Chinese Classics,[6] and in the *Rh-ya*, a herbal dating from

ratio Plantarum Zeylaniæ, 1864. ult also Meissner in De Cand. ect. i. 10.

ylvatica for Southern India, 1872.

rer and Navigation of the An- Indian Ocean, ii. (1807) 512.

[4] Chishull, *Antiquitates Asiaticæ*, 1728. 65 72.

[5] *Ceylon*, i. (1859) 575.

[6] We are indebted to Dr. Bretschneider of Pekin for these references to Chinese literature. For information about some of the works quoted, see his pamphlet *On the Study and Value of Chinese Botanical Works*, 1870.

1200 B.C. In the *Hai-yao-pên-ts'ao*, written in the 8th century, m is made of *Tien-chu kwei.* Tien-chu is the ancient name for I perhaps the allusion may be to the cassia bark of Malabar.

In connexion with these extremely early references to the sp may be stated that a bark supposed to be *cassia* is mentioned as im into Egypt together with gold, ivory, frankincense, precious wood apes, in the 17th century B.C.[1]

The accounts given by Dioscorides, Ptolemy and the author Periplus of the Erythrean Sea, indicate that cinnamon and were obtained from Arabia and Eastern Africa; and we further that the importers were Phœnicians, who traded by Egypt and th Sea with Arabia. Whether the spice under notice was really a p tion of Arabia or Africa, or whether it was imported thither from So China (the present source of the best sort of cassia) is a question has excited no small amount of discussion.

We are in favour of the second alternative,—firstly, because n stance of the nature of cinnamon is known to be produced in Ar Africa; and secondly, because the commercial intercourse whic undoubtedly carried on by China with India and Arabia, and whic existed between Arabia, India and Africa, is amply sufficient to e the importation of Chinese produce.[2] That the spice was a prod of the far East, is moreover implied by the name *Darchini* (from *dar* or bark, and *Chini*, Chinese), given to it by the Arabians and Pers

If this view of the case is admissible, we must regard the a cinnamon to have been the substance now known as *Chinese Cassia* or *Chinese Cinnamon*, and cassia as one of the thicker and perha aromatic barks of the same group, such in fact as are still fou commerce.

Of the circumstances which led to the collection of cinnam Ceylon, and of the period at which it was commenced, neth known. That the Chinese were concerned in the discovery is a unreasonable supposition, seeing that they traded to Ceylon, and in all probability acquainted with the cassia-yielding species o *namomum* of Southern China, a tree extremely like the cinnamo of Ceylon.

Whatever may be the facts, the early notices of cinnamon as duction of Ceylon are not prior to the 13th century. The ver according to Yule,[3] is a mention of the spice by Kazwini, an writer of about A.D. 1275, very soon after which period it is noti John of Montecorvino, a missionary friar who visited India. man, in a letter under date 1292 or 1293, still extant in the Me library at Florence, says that the cinnamon tree is of medium bul

[1] Dümichen, *Fleet of an Egyptian Queen*, Leipzig, 1868, p. 1.

[2] ". . That there was an ulterior commerce beyond Ceylon is indubitable; for at Ceylon the trade from Malacca and the Golden Chersonese, met the merchants from Arabia, Persia and Egypt. This might possibly have been in the hands of the Malays or even the Chinese, who seem to have been navigators in all ages as universally as the Arabians. . . . . ." Vincent, op. cit. ii. 284. 285.—In the time of Marco Polo, the trade of China westward, met the the Red Sea, no longer in Ceylon, b coast of Malabar, apparently at where the Portuguese found it on th arrival. Here, says Marco, the sh Aden obtained their lading from th and carried it into the Red Sea for dria, whence it passed into Europe of the Venetians.—See also Yule. *Ser Marco Polo*, ii. (1871) 325. 327.

[3] Op. cit. ii. 255.

unk, bark and foliage, like a laurel, and that great store of its bark rried forth from the island which is near by Malabar.[1]

igain, it is mentioned by the Mahomedan traveller Ibn Batuta about 1340,[2] and a century later by the Venetian merchant Nicolo di i, whose description of the tree is very correct.[3]

'he circumnavigation of the Cape of Good Hope led to the real dis- ry of Ceylon by the Portuguese in 1505, and to their permanent pation of the island in 1536, chiefly for the sake of the cinnamon. from the first of these dates that more exact accounts of the spice n to reach Europe. Thus in 1511, Barbosa distinguished the fine mon of Ceylon from the inferior *Cannella trista* of Malabar. Garcia a about the middle of the same century, stated that Ceylon cinnamon forty times as dear as that of Malabar. Clusius, the translator of ia, saw branches of the cinnamon-tree as early as 1571, at Bristol in Holland.

it this period, cinnamon was cut from trees growing wild in the ts in the interior of Ceylon, the bark being exacted as tribute from Singhalese kings by the Portuguese. A peculiar caste called *chalias*, are said to have emigrated from India to Ceylon in the 13th century, who in after-times became cinnamon-peelers, delivered the bark to 'ortuguese. The cruel oppression of these *chalias* was not mitigated e Dutch, who from the year 1656 were virtually masters of the whole ard, and conceded the cinnamon trade to their East India Company profitable monopoly, which the Company exercised with the greatest ity.[4] The bark previous to shipment was minutely examined by al officers, to guard against frauds on the part of the *chalias*.

bout 1770, De Koke conceived the happy idea, in opposition to the rsal prejudice in favour of wild-growing cinnamon, of attempting ultivation of the tree. This project was carried out under Gover- Falck and Van der Graff with extraordinary success, so that the h were able independently of the kingdom of Kandy, to furnish t 400,000 lb. of cinnamon annually, thereby supplying the entire pean demand. In fact, they completely ruled the trade, and would *burn* the cinnamon in Holland, lest its unusual abundance should e the price.

after Ceylon had been wrested from the Dutch by the English in , the cinnamon trade became the monopoly of the English East Company, who then obtained more cinnamon from the forests, ially after the year 1815, when the kingdom of Kandy fell r British rule. But though the *chalias* had much increased in ers, the yearly production of cinnamon does not appear to have ded 500,000 lb. The condition of the unfortunate *chalias* was not iorated until 1833, when the monopoly granted to the Company was y abolished, and Government ceasing to be the sole exporters of mon, permitted the merchants of Colombo and Galle to share in rade.

innamon however was still burdened with an export duty equal to rd or a half of its value, in consequence of which and of the com-

[1] le, *Cathay and the way thither*, i. 213.
[2] *avels of Ibn Batuta*, translated by ond. 1829. 184.
[3] musio, *Raccolta delle Navigationi et Viaggi*, i. (1563) 339; Kunstmann, *Kenntniss Indiens im fünfzehnten Jahrhundert*, 1863. 39.
[4] Tennent, op. cit. ii. 52.

petition with cinnamon raised in Java, and with cassia from China other places, the cultivation in Ceylon began to suffer. This duty not removed until 1853.

The earliest notice of cinnamon in connexion with Northern E that we have met with, is the diploma granted by Chilperic II., ki the Franks, to the monastery of Corbie in Normandy, A.D. 716, in provision is made for a certain supply of spices and grocery, incl 5 ℔. of *Cinnamon.*[1]

The extraordinary value set on cinnamon at this period is remar illustrated by some letters written from Italy, in which mention is and there incidentally made of presents of spices and incense.[2] in A.D. 745, Gemmulus, a Roman deacon, sends to Boniface, archb of Mayence ("*cum magnâ reverentiâ*"), 4 ounces of *Cinnamon*, 4 o of Costus, and 2 pounds of Pepper. In A.D. 748, Theophilacias, a R archdeacon, presents to the same bishop similar spices and in Lullus, the successor of Boniface, sends to Eadburga, *abbatissa Thand circa* A.D. 732–751—"*unum graphium argenteum et storacis et* cinna *partem aliquam*"; and about the same date, another present of cinn to archbishop Boniface is recorded. Under date A.D. 732–742, a l is extant of three persons to the abbess Cuneburga, to whom the w offer—"*turis et piperis et* cinnamomi *permodica xenia, sed omni a affectione destinata.*"

Of the pecuniary value of this price in England, there are notices from the year 1264 downwards.[4] In the 16th century it probably not plentiful, if we may judge from the fact that it fi among the New Year's gifts to Philip and Mary (1556–57), and to Q Elizabeth (1561–62).[5]

Production and Commerce[6]—The best cinnamon is prod according to Thwaites[7] from a cultivated or selected form of the (var. *α.*), distinguished by large leaves of somewhat irregular s But the bark of all the forms possesses the odour of cinnamon greater or less degree. It is not however always possible to judge c quality of the bark from the foliage, so that the peelers when colle from uncultivated trees, are in the habit of tasting the bark b commencing operations, and pass over some trees as unfit for purpose. The bark of varieties *β. multiflorum* and *γ. ovalifolium* very inferior quality, and said to be never collected unless fo purpose of adulteration.

The best variety appears to find the conditions most favourable culture, in the strip of country, 12 to 15 miles broad, on the south coast of Ceylon, between Negumbo, Colombo and Matura, when tree is grown up to an elevation of 1500 feet. A very sandy clay or fine white quartz, with a good sub-soil and free exposure to

[1] Pardessus, *Diplomata*, etc., Paris 1849. ii. 309.

[2] Jaffé, *Bibliotheca Rerum Germanicarum*, Berlin, iii. (1866) 154. 199. 214. 216–8. 109.

[3] Doubtless *Eadburh*, third abbess of Minster in the Isle of Thanet in Kent. She died A.D. 751.

[4] Eden, *State of the Poor*, ii. (1797) appendix; Rogers, *Hist. of Agriculture and Prices in England*, ii. (1866) 543.

[5] Nicholls, *Progresses and Proces Q. Elizabeth*, i. (1823) xxxiv. 118.

[6] Additional information may be fo two papers by Marshall, in Thomson's *of Philosophy*, x. (1817) 241 and 34 also Lesechenault de la Tour, *M Musée d'Hist. nat.* viii. (1822) 436–44

[7] Op. cit. 252–253.

ınd rain, are the circumstances best adapted for the cultivation. management of the plantations resembles that of oak coppice in .nd. The system of pruning checks the plant from becoming a ınd induces it to form a stool from which four or five shoots are ɜd to grow; these are cut at the age of 1½ to 2 years, when the h-green epidermis begins to turn brown by reason of the formation orky layer. They are not all cut at the same time, but only as ırrive at the proper state of maturity; they are then 6 to 10 feet and ½ to 2 inches thick. In some of the cinnamon gardens at ıbo, the stools are very large and old, dating back it is supposed, the time of the Dutch.

ı consequence of the increased flow of sap which occurs after the rains in May and June, and again in November and December, ırk at those seasons is easily separated from the wood, so that a pal harvest takes place in the spring, and a smaller one in the part of the year.

ıe shoots having been cut off by means of a long sickle-shaped called a *catty*, and stripped of their leaves, are slightly trimmed with ife, the little pieces thus removed being reserved and sold as *mon Chips*. The bark is next cut through at distances of about a ınd slit lengthwise, when it is easily and completely removed by sertion of a peculiar knife termed a *mama*, the separation being ɜd if necessary, by strongly rubbing with the handle. The pieces rk are now carefully put one into another, and the compound sticks bound together into bundles. Thus they are left for 24 hours or during which a sort of "*fermentation*" (!) goes on which facilitates ıbsequent removal of the exterior part. This is accomplished by g each quill on a stick of wood of suitable thickness, and carefully ng off with a knife the outer and middle cortical layer. In a ours after this operation, the peeler commences to place the smaller within the larger, also inserting the small pieces so as to make up nost solid stick, of about 40 inches in length. The cinnamon thus red is kept one day in the shade, and then placed on wicker trays e sun to dry. When sufficiently dry, it is made into bundles of 30 lb. each.[1]

ıe cinnamon gardens of Ceylon were estimated in 1860–64, to y an area of about 14,400 acres.[2] At present the cultivation of is displacing that of cinnamon. Mr. Horne of the Botanical ın of Mauritius, writing in 1866, observes that no new plantations ɔw laid out, and that many of the old ones are going to ruin. The ts of cinnamon from Ceylon have been as follows:—

1871	1872
1,359,327 lb., value £67,966.	1,267,953 lb., value £64,747.

f the last named quantity, 1,179,516 lb. were shipped to the United lom, 53,439 lb. to the United States of North America, and 10,000 lb. mburg. Besides the above-named exports of cinnamon, the official

merly called *fardelo* or *fardello*, a ignifying in the Romance languages or *package*. The word *fardel* having ıe meaning, is found in old English

ı the cultivation was far more extensive in the earlier part of the century, as we may judge by the statement that the five principal cinnamon gardens around Negumbo, Colombo, Barberyn, Galle, and Matura, were *each from 15 to 20 miles in circumference* (Tennent's Ceylon, ii. 163).

statistics[1] record the export of "*Cinnamon Bark*"—8846 lb. in 187 23,449 lb. in 1872. This name includes two distinct articles, nam *Cinnamon Chips*, and a very thick bark derived from old stems. *Cinnamon Chips* which, as explained on the previous page, are the trimmings of the shoots, are very aromatic; they used to be consid worthless, and were thrown away. The second article, to which in London drug sales the name "*Cinnamon Bark*" is restricted, is in fl slightly channelled fragments, which are as much as $\frac{4}{10}$ of an in thickness, and remind one of New Granada cinchona bark. It is deficient in aromatic qualities, and quite unfit for use in pharmacy.

In most other countries into which *Cinnamomum Zeylanicum* has transplanted, it has been found that, partly from its tendency to into new varieties and partly perhaps from want of careful cultiv and the absence of the skilled cinnamon-peeler, it yields a appreciably different from that of Ceylon. Of other cinnamon-produ districts, those of Southern India may be mentioned as affording *Malabar* or *Tinnevelly*, and the *Tellicherry Cinnamon* of commerce latter being almost as good as the cinnamon of Ceylon.[2] The cultiv in Java commenced in 1825. The plant according to Miquel is a va of *C. Zeylanicum*, distinguished by its very large leaves which are quently 8 inches long by 5 inches broad. The island exported in 1109 peculs (147,866 lb.); in 1871 only 446 peculs (59,466 lb.).[3]

Cinnamon is also grown in the French colony of Guyana an Brazil, but on an insignificant scale. The samples of the bark from countries which we have examined are quite unlike the cinnam Ceylon. That of Brazil in particular has evidently been taken stems several years old.

The importations of cinnamon into the United Kingdom from C are declining, as the following figures will show :—

1869	1870	1871	1872
2,611,473 lb.	2,148,405 lb.	1,430,518 lb.	1,015, 461 lb.

During 1872, 56,000 lb. of cinnamon were imported from countries.

Description—Ceylon cinnamon of the finest description, is imp in the form of sticks, about 40 inches in length and $\frac{3}{4}$ of an in thickness, formed of tubular pieces of bark about a foot long, dexte arranged one within the other, so as to form an even rod of consid firmness and solidity. The quills of bark are not rolled up as s tubes, but each side curls inwards so as to form a channel with in-cu sides, a circumstance that gives to the entire stick a somewhat fla cylindrical form. The bark composing the stick is extremely measuring often no more than $\frac{1}{100}$ of an inch in thickness. It light brown, dull surface, faintly marked with shining wavy line bearing here and there scars or holes at the points of insertion of or twigs. The inner surface of the bark is of a darker hue. Th is brittle and splintery, with a fragrant odour, peculiar to itself a allied barks of the same genus. Its taste is saccharine, pungen aromatic.

The bales of cinnamon which arrive in London are always re-

[1] *Ceylon Blue Books* for 1871 and 1872, printed at Colombo.

[2] Some of it however is very thick neatly quilled.

[3] *Consular Reports*, Aug. 1873. 95

he dock warehouses, in doing which a certain amount of breakage ura. The spice so injured is kept separate and sold as *Small Cinnon*, and is very generally used for pharmaceutical purposes. It is n of excellent quality.

Microscopic Structure—By the peeling above described, Ceylon namon is deprived of the suberous coat and the greater part of the ldle cortical layer, so that it almost consists of the mere liber (*endoæum*). Three different layers are to be distinguished on a transverse tion of this tissue:—

1. The external surface which is composed of one to three rows of e thick-walled cells, forming a coherent ring; it is only interrupted bundles of liber-fibres, which are obvious even to the unaided eye; y compose in fact the wavy lines mentioned in the last page.

2. The middle layer is built up of about ten rows of parenchymatous n-walled cells, interrupted by much larger cells containing deposits of cilage, while other cells, not larger than those of the parenchyme lf, are loaded with essential oil.

3. The innermost layer exhibits the same thin-walled but smaller ls, yet intersected by narrow, somewhat darker, medullary rays, and wise interrupted by cells containing either mucilage or essential oil. Instead of bundles of liber-fibres, fibres mostly isolated are scattered ough the two inner layers, the parenchyme of which abounds in ll starch granules accompanied by tannic matter. On a longitudinal tion, the length of the liber-fibres becomes more evident, as well as oil-ducts and gum-ducts.

Chemical Composition—The most interesting and noteworthy stituent of cinnamon is the essential oil, which the bark yields to the ent of ½ to 1 per cent., and which is distilled in Ceylon,—very seldom England. It was prepared by Porta [1] of Naples, who mentions it as y as 1589. In the latter part of the last century, it used to be ught to Europe by the Dutch. During the five years from 1775 to 9 inclusive, the average quantity *annually* disposed of at the sales the Dutch East India Company was 176 ounces. The wholesale e in London between 1776 and 1782, was 21*s.* per ounce; but from 5 to 1789, the oil fetched 63*s.* to 68*s.*, the increase in value being btless occasioned by the war with Holland commenced in 1782. The is now largely produced in Ceylon, from which island the quantity orted in 1871 was 14,796 ounces; and in 1872, 39,100 ounces.[2] The is shipped chiefly to England.

Oil of cinnamon is a golden-yellow liquid, having a sp. gr. of 1·035, werful cinnamon odour, and a sweet and aromatic but burning taste. leviates a ray of polarized light a very little to the left. The oil ists chiefly of *Cinnamic Aldehyde*, C^9H^8O, together with a variable ortion of hydrocarbons. At a low temperature it becomes turbid the deposit of a camphor, which we have not examined. The oil ly absorbs oxygen, becoming thereby contaminated with resin and amic acid.

Cinnamon contains sugar, mannite, starch, mucilage, and tannic acid. *Cinnamomin* of Martin (1868) has been shown by Wittstein to be

[1] *Magiæ Naturalis libri xx.* Neap. 1589. [2] *Ceylon Blue Books* for 1871 and 1872.

very probably merely mannite. The effect of iodine on a decocti cinnamon will be noticed under the head of Cassia Lignea. Cinn afforded to Schätzler (1862) 5 per cent. of ash consisting chiefly o carbonates of calcium and potassium.

Uses—Cinnamon is used in medicine as a cordial and stim but is much more largely consumed as a spice.

Adulteration—Cassia lignea being much cheaper than cinn is very commonly substituted for it. So long as the bark is entire, is no difficulty in its recognition, but if it should have been reduc powder, the case is widely different. We have found the following of some service, when the spice to be examined is in powder:—M decoction of powdered cinnamon of known genuineness; and o similar strength of the suspected powder. When cool and strained a fluid ounce of each with one or two drops of tincture of iodin decoction of cinnamon is but little affected, but in that of cas deep blue-black tint is immediately produced (see p. 479). The kinds of cassia known as *Cassia vera*, may be distinguished fro more valuable *Chinese Cassia* as well as from cinnamon, by their ric in mucilage. This can be extracted by cold water as a thick g liquid, giving dense ropy precipitates with corrosive sublimate or ne acetate of lead, but not with alcohol.

Other products of the Cinnamon Tree.

Essential Oil of Cinnamon Leaf (*Oleum Cinnamomi folior* This is a brown, viscid, essential oil, of clove-like odour, which is s times exported from Ceylon. It has been examined by Stenhouse (1 who found it to have a sp. gr. of 1·053, and to consist of a mixtu *Eugenic Acid* (p. 253) with a neutral hydrocarbon having the for $C^{10}H^{16}$. It also contains a small quantity of benzoic acid.

Essential Oil of Cinnamon Root (*Oleum Cinnamomi radic* A yellow liquid, lighter than water, having a mixed odour of cam and cinnamon, and a strong camphoraceous taste. Both this oil that of the leaf were described by Kämpfer (1712) and by Seba in 1 and perhaps by Garcia d'Orta so early as 1563. Solid camphor may be obtained from the root. A water distilled from the flowers, a fatty oil expressed from the fruits are likewise noticed by old wr but are unknown to us.

CORTEX CASSIÆ LIGNEÆ.

Cassia Lignea, Cassia Bark.

Botanical Origin—Various species of *Cinnamomum* occurri the warm countries of Asia from India eastward, afford what is te in commerce *Cassia Bark*. The trees are extremely variable in fo inflorescence and aromatic properties, and the distinctness of seve the species laid down even in recent works is still uncertain.

The bark which bears *par excellence* the name of *Cassia* or *C lignea*, and which is distinguished on the Continent as *Chinese Cinn* is a production of the provinces of Kwangsi and Kweichau in Sou

[1] *Phil. Trans.* xxxvi. (1731) 107.

he French expedition of Lieut. Garnier for the exploration of the ınd of Cochin China (1866–68) found cassia growing in about ˆ in the forests of one of the affluents on the left bank of the ıear the frontiers of Annam. A part of this cassia is carried ıto China, while another part is conveyed to Bangkok.[1] Although ɔmary to refer it without hesitation to a tree named *Cinna-Cassia*, we find no warrant for such reference: no competent has visited and described the cassia-yielding districts of China ıd brought therefrom the specimens requisite for ascertaining ical origin of the bark.[2]

ı lignea is also produced in the Khasya mountains in Eastern hence it is brought down to Calcutta for shipment.[3] In this ere are three species of *Cinnamomum*, growing at 1000 to 4000 ɔ the sea-level, and all have bark with the flavour of cinnamon, less pure: they are *C. obtusifolium* Nees, *C. pauciflorum* Nees, *ımala* Fr. Nees et Eberm.

momum iners Reinw., a very variable species occurring in Con- India, Ceylon, Tavoy, Java, Sumatra and other islands of the rchipelago, and possibly in the opinion of Thwaites a mere *C. Zeylanicum*, but according to Meissner well distinguished er, thinner leaves, its nervation, and the character of its aroma, pear to yield the cassia bark or wild cinnamon of Southern

mala Fr. Nees et Eberm., which besides growing in Khasya is the contiguous regions of Silhet, Sikkim, Nepal, and Kumaon, ı reaches Australia, probably affords some cassia bark in India.

quantities of a thick sort of cassia have at times been imported gapore and Batavia, much of which is produced in Sumatra. In ce of any very reliable information as to its botanical sources, suggest as probable mother-plants, *C. Cassia* Bl. and *C. Bur-*, var. *a*, *Chinense*, both stated by Teijsmann and Binnendijk to ıted in Java.[5] The latter species growing also in the Philippines, ɔably affords the cassia bark which is shipped from Manila.

ɔry—In the preceding article, we have indicated (p. 467) the eriod at which cassia bark appears to have been known to the and have stated the reasons that lead us to believe the cin- f the ancients was that substance. It must, however, be that Theophrastus, Dioscorides, Pliny, Strabo and others, as he remarkable inscription on the temple of Apollo at Miletus, cinnamon and cassia as distinct, but nearly allied sub- While on the other hand, the author of the Periplus of the ı Sea, in enumerating the products shipped from the various

Notes médicales du Voyage d'Ex- ı Mekong et de Cochinchine, Paris,

atest market in China for cassia ɔn according to Dr. F. Porter aiwu in Ping-nan hien (Sin-chau ngsi province.—*Mat. Med. and f China*, 1871. 52.—The capital is Kweilin fu, literally *Cassia-*

[3] Hooker, *Himalayan Journals*, ed. 2. ii. (1855) 303.

[4] A specimen of the stem-bark of *C. iners* from Travancore, presented to us by Dr. Waring, has a delightful odour, but is quite devoid of the taste of cinnamon.

[5] *Catalogus Plantarum quæ in Horto Botanico Bogoriensi coluntur*, Batavia, 1866. 92.

commercial ports of Eastern Africa[1] in the first century, mentions (κασία or κασσία) of various kinds, but never employs the wor namon (κινναμώμον).

In the list of productions of India on which duty was levied Roman custom house at Alexandria, *circa* A.D. 176–180, *Cinnam* is mentioned as well as *Cassia turiana*, *Xylocassia* and *Xylocinnamo* Of the distinction here drawn between cinnamon and cassia, we ca no explanation; but it is worthy of note that *twigs* and *branch* *Cinnamomum* are sold in the Chinese drug shops, and may n probably be the *xylocassia* or *xylocinnamon* of the ancients.[3] The *Cassia lignea* would seem to have been originally bestowed on som substance, rather than as at present, on a mere bark. The spic also undoubtedly called *Cassia syrinx* and *Cassia fistularis* (p. 1 names which evidently refer to a bark which had the form tube. In fact there may well have been a diversity of qualities, perhaps very costly. It is remarkable that such is still the in China, and that the wealthy Chinese employ a thick vari cassia, the price of which is as much as 18 dollars per catty, or 56*s.* per ℔.[4]

Whether the *Aromata Cassiæ*, which were presented to the C at Rome under St. Silvester, A.D. 314–335, was the modern bark, is rather doubtful. The largest donation, 200 ℔., whic accompanied by pepper, saffron, storax, cloves, and balsam, would a to have arrived from Egypt.[5] Cassia seems to have been know Western Europe as early as the 7th century, for it is mentioned cinnamon by St. Isidore, archbishop of Seville.[6] Cassia is nam one of the Leech-books in use in England prior to the Norman quest.[7] The spice was sold in London as *Canel*, in 1264, at 10*d.* p sugar being at the same time 12*d.*, cumin 2*d.*, and ginger 18*d.*[8] I *Boke of Nurture*[9] written in the 15th century by John Russell, cha lain to Humphry, duke of Gloucester, cassia is spoken of as resem cinnamon, but cheaper and commoner, exactly as at the present da

Production — We have no information whether the tree affords the cassia bark of Southern China is cultivated, or wh it is exclusively found wild.

The Calcutta cassia bark collected in the Khasya mountain

[1] Vincent, *Commerce and Navigation of the Ancients in the Indian Ocean*, ii. (1807) 130. 134. 149. 150. 157.—That the ancients should confound the different kinds of cassia is really no matter for surprise, when we moderns, whether botanists, pharmacologists, or spice-dealers, are unable to point out characters by which to distinguish the barks of this group, or even to give definite names to those found in our warehouses.

[2] Vincent, op. cit. ii. 701 716.

[3] In 1872, no less than 456,533 ℔. of this *wood of cassia* or *Cassia Twigs*, were shipped from Canton, for the most part to other Chinese ports.—*Returns of Trade at the Treaty Ports in China for* 1872, p. 34.

[4] Very fine specimens of this costly bark have been kindly supplied to us by Dr. H. F. Hance, British Vice-Consul at Whampoa.

[5] Vignolius, *Liber Pontificalis*, R. (1724) 94. 95.

[6] Migne, *Patrologiæ Cursus*, lxxxii. 622.—St. Isidore evidently quotes but his remarks imply that both were known at the period when he w

[7] Cockayne, *Leechdoms*, &c., of *England*, ii. (1865) 143.

[8] Rogers, *Hist. of Agriculture* in *England*, ii. (1866) 543.

[9] The book has been reprinted f Early English Text Society, 1868.—I says :—"Looke that your stikkes o *mome* be thyñ, bretille and fayre in . . . . for *canelle* is not so good in this and cure."—And in his directions " *make Ypocras*," he prescribes syna that "*for lordes*," but "*canelle*" in th "*commyn peple*."

ought to Calcutta is afforded by wild trees of small size. Dr. Hooker o visited the district with Dr. Thomson in 1850, observes that the de in the bark is of recent introduction.[1] The bark which varies ch in thickness, has been scraped of its outer layer.

Cassia is extensively produced in Sumatra, as may be inferred from fact that Padang in that island, exported of the bark in 1871, 6128 culs (817,066 lb.), a large proportion of which was shipped to America.[2] garding the collection of cassia on the Malabar coast, in Java and in Philippines, no particular account has, so far as we know, been blished. Spain imported from the Philippines by way of Cadiz in 71, 93,000 lb. of cassia.[3]

Description — *Chinese Cassia lignea*, otherwise called *Chinese nnamon*, which of all the varieties is that most esteemed, and apaching most nearly to Ceylon cinnamon, arrives in small bundles out a foot in length and a pound in weight, the pieces of bark being ld together with bands of bamboo.

The bark has a general resemblance to cinnamon, but is in simple ills, not inserted one within the other. The quills moreover are less aight, even and regular, and are of a darker brown; and though some the bark is extremely thin, other pieces are much stouter than fine nnamon,—in fact, it is much less uniform. The outer coat has been moved with less care than that of Ceylon cinnamon, and pieces can sily be found with the corky layer untouched by the knife.

Cassia bark breaks with a short fracture. The thicker bark cut nsversely, shows a faint white line in the centre running parallel with surface. Good cassia in taste resembles cinnamon, than which it is t less sweet and aromatic, though it is often described as less fine and licate in flavour.

An unusual kind of cassia lignea has been recently (1870) imported m China and offered in the London market as *China Cinnamon*,[4] ough it is not the bark that bears this name in continental trade. The w drug is in *unscraped* quills which are mostly of about the thickness ordinary Chinese cassia lignea; it has a very saccharine taste and ngent cinnamon flavour.

The less esteemed kinds of cassia bark, which of late years have en poured into the market in vast quantity, are known in commerce *Cassia lignea*, *Cassia vera* or *Wild Cassia*, and are further distinished by the names of the localities whence shipped, as Calcutta, Java, nor, &c.

The barks thus met with, vary exceedingly in colour, thickness and nma, so that it is vain to attempt any general classification. Some ve a pale cinnamon hue, but most are of a deep rich brown. They nent all variations in thickness, from that of cardboard to more than quarter of an inch thick. The flavour is more or less that of cinnamon, en with some unpleasant addition suggestive of insects of the genus mex. Many, besides being aromatic, are highly mucilaginous, the ucilage being freely imparted to cold water. Finally, we have met

Hooker, op. cit.

Consular Reports, August 1873. 953.

Consul Reade, *Report on the Trade, &c., Cadiz for* 1871, where the spice is called nnamon."

[4] Messrs. Dalton and Young of Cullum Street have obligingly supplied us with a sample of this bark. See also Fluckiger in Wiggers and Husemann's *Jahresbericht* for 1872. 52.

with some thick cassia bark of good appearance that was disting by astringency and the almost entire absence of aroma.[1]

Microscopic Structure—A transverse section of such pie *Chinese Cassia lignea* as still bear the suberous envelope, exhibi following characters. The external surface is made up of several of the usual cork-cells, loaded with brown colouring matter. In from which the cork-cells have been entirely scraped, the surf formed of the mesophlœum, yet by far the larger part of the bark b to the liber or endophlœum. Isolated liber-fibres and thick-w cells (stone-cells) are scattered even through the outer layers of a t verse section. In the middle zone they are numerous, but do not a coherent sclerenchymatous ring as in cinnamon (p. 473). The i most part of the liber shares the structural character of cinn with differences due to age, as for instance the greater developme the medullary rays. Oil-cells and gum-ducts are likewise distribut the parenchyme of the former.

The "*China Cinnamon*" of 1870 (p. 477) comes still nearer to C cinnamon, except that it is coated. A transverse section of a not thicker than one millimetre, exhibits the three layers describe characterizing that bark. The sclerenchymatous ring is covered parenchyme rich in oil-ducts, so that it is obvious that the flavo this drug could not be improved by scraping. The corky layer is posed of the usual tabular cells. The liber of this drug in fact a with that of Ceylon cinnamon.

In *Cassia Barks of considerable thickness*, the same arrangeme tissues is met with, but their strong development causes a certain similarity. Thus the thick-walled cells are more and more sepa one from another, so as to form only small groups. The same ap also to the liber-fibres, which in thick barks are surrounded by a p chyme, loaded with considerable crystals of oxalate of calcium. gum-ducts are not larger, but are more numerous in these barks, w swell considerably in cold water.

Chemical Composition—Cassia bark owes its aromatic prop to an essential oil, large quantities of which are shipped from Ca In a chemical point of view, no difference can be pointed out be this oil and that of Ceylon cinnamon. The flavour of cassia oil is s what less agreeable, and as it exists in the less valuable sorts of decidedly different in aroma from that of cinnamon. We find the s of a Chinese cassia oil to be 1·066, and its rotatory power in a c 50 mm. long, only 0°·1 to the right, differing consequently in this re from that of cinnamon oil (p. 473).

Oil of cassia sometimes deposits a stearoptene, which when pu is a colourless, inodorous substance, crystallizing in shining brittle pr We have never met with it.

If thin sections of cassia bark are moistened with a dilute so of perchloride of iron, the contents of the parenchymatous part o whole tissue assume a dingy brown colour; in the outer layers the s

[1] It is a bark of this kind that the late Professor Guibourt considered to be the true *Cassia lignea* and to which he restricted the name.—*Hist. des Drogues*, ii. (1849) 380.

[2] Rochleder and Schwarz in G *Chemistry*, xvii. 395.

es even are coloured. *Tannic matter* is consequently one of the :onstituents of the bark; the very cell-walls are also imbued with decoction of the bark is turned blackish green by a per-salt of

cassia bark (or Ceylon cinnamon) is exhausted by *cold water*, the iquid becomes turbid on addition of iodine; the same occurs if a ıtrated solution of iodide of potassium is added. An abundant itate is produced by addition of iodine dissolved in the potassium The colour of iodine then disappears. There is consequently a nce present, which unites with iodine; and in fact, if to a *decoction* ıia or cinnamon, the said solution of iodine is added, it strikes a blue coloration, due to starch. But the colour quickly disappears, ecomes permanent only after much of the test has been added. ıve not ascertained the nature of the substance that thus modifies tion of iodine: it can hardly be tannic matter, as we have found action to be the same when we used bark that had been pre- y repeatedly treated with spirit of wine and then several times oiling ether.

.e mucilage contained in the gum-cells of the thinner quills of is easily dissolved by cold water, and may be precipitated together :annin, by neutral acetate of lead, but not by alcohol. In the r barks it appears less soluble, merely swelling into a slimy jelly.

ımmerce—Cassia lignea is exported from Canton in enormous ıcreasing quantities. The shipments which in 1864 amounted to) peculs, reached 40,600 in 1869,[1] 61,220 in 1871, and 76,464 peculs 5,200 lb.) value £267,703, in 1872.[2] A very large proportion of ssia bark imported into England is reshipped to other countries.

l of cassia was shipped from the south of China to the United om, to the extent in 1869, of 47,517 lb.; in 1870, of 28,389 lb.[3]

ses—The same as those of cinnamon.

Allied Products.

ıssia Buds—These are the *immature fruits* of the tree yielding ıe cassia lignea, and have been used in Europe since the middle In the journal of expenses (A.D. 1359–60) of John, king of France, a prisoner at Somerton Castle in England, there are several entries : spice under the name of *Flor de Canelle;* it was very expensive, ; from 8*s.* to 13*s.* per lb., or more than double the price of mace or On one occasion two pounds of it had to be obtained for the use from Bruges.[4] From the *Form of Cury*[5] written in 1390, it s that cassia buds ("*Flō de queynel*") were used in preparing the wine called *Hippocras.*

ssia buds are shipped from Canton, but the exports have much ed. Rondot, writing in 1848,[6] estimated them as averaging 400

ton Trade Report for 1869.
mercial Reports from H.M. Consuls ı, presented to Parliament 1873,—Robertson).
ıual Statement of the Trade and ion of the United Kingdom for 1870.
o later returns accessible.

[4] Douet d'Arcq, *Comptes de l'Argenterie des Rois de France*, 1851. 206. 218. 222. 239 &c.

[5] See p. 217, note 8.

[6] *Commerce d'exportation de la Chine*, 45.

peculs (53,333 lb.) a year. In 1866, there were shipped from Ca only 233 peculs (31,066 lb.); in 1867, 165 peculs (22,000 lb.)[1] quantity of Cassia Buds imported into the United Kingdom in 1870 29,321 lb.;[2] the spice is sold chiefly by grocers.

In Southern India, the more mature fruits of one of the variet *Cinnamomum iners* Reinw. are collected for use, but are very infer the Chinese cassia buds.

Folia Malabathri—is the name given to the dried, aromatic l of certain Indian species of *Cinnamomum*, formerly employed in Eur medicine, but now obsolete. Under the name *Taj-pát*, the leave still used in India; they are collected in Mysore from wild trees.

Ishpingo—This is the designation in Quito of the calyx of a tr the laurel tribe, used in Ecuador and Peru in the place of cinn Though but little known in Europe, it has a remarkable history.

The existence of a spice-yielding region in South America, h come to the ears of the Spanish conquerors, was regarded as a mat such high importance that an expedition for its exploration was out. The direction of the enterprise was confided to Gonzalo Pi who with 340 soldiers, and more than 4000 Indians, laden with sup quitted the city of Quito on Christmas Day, 1539. The exped which lasted two years, resulted in the most lamentable failure, 130 Spaniards surviving the hardships of the journey. In the ac of it given by Garcilasso de la Vega, the cinnamon tree is describ having large leaves like those of a laurel, with fruits resembling a growing in clusters.[3] Oviedo[4] has also given some particulars rega the spice, together with a figure fairly representing its remarkable f and the subject has been noticed by several other Spanish wr including Monardes.[5]

Notwithstanding the celebrity thus conferred on the spice, an fact that the latter gives its name to a large tract of country,[6] a still the object of a considerable traffic, the tree itself is all but unk to science. Meissner places it doubtfully under the genus *Nectr* with the specific name *cinnamomoides*, but confesses that its flower fruits are alike unknown.[7]

The spice, for an ample specimen of which we have to than Destruge, of Guayaquil, consists of the enlarged and matured v calyx, 1½ to 2 inches in diameter, having the shape of a shallow fu the open part of which is a smooth cup (like the cup of an acorn) rounded by a broad, irregular margin, usually recurved. The outer s is rough and veiny, and the whole calyx is dark brown, and has a s

[1] *Reports on Trade at the Treaty Ports in China for* 1867, Shanghai, 1868. 94.

[2] *Annual Statement of the Trade and Navigation of the U.K. for* 1870. 101.

[3] *Travels of Pedro de Cieza de Leon*, A.D. 1532–50, translated by Markham (Hakluyt Society) Lond. 1864. chap. 39–40; also *Expedition of Gonzalo Pizarro to the Land of Cinnamon*, by Garcilasso Inca de la Vega, forming part of the same volume.

[4] *Historia de las Indias*, Madrid, i. (1851) 357. (lib. ix. c. 31).

[5] *De la Canela de nuestras Indias.—Historia de las cosas que se traen de nuestras Indias occidentales*, Sevilla, 1574. 95.

[6] The village of San José de Canela may be considered as the centre of t namon region, was determined by Mr. to be in lat. 1°20 S., long. 77° 45 W., an altitude above the sea of 1590 feet Forest of Canelos, he tells us, has no boundaries; but the term is popul signed to all the upper region of th tasa and its tributaries, from a he 4000 to 7000 feet on the slopes of the down to the Amazonian plain, and t fluence of the Bombonasa and Pastas

[7] De Candolle, *Prodromus*, xv. sect

veet, aromatic taste, like cinnamon, for which in Ecuador it is the mmon substitute.

Dr. Destruge has also furnished us with a specimen of the *bark*, hich is in very small uncoated quills, exactly simulating true cinnamon. Ve are not aware whether the bark is thus prepared in quantity.

CORTEX BIBIRU.

Cortex Nectandræ; Greenheart Bark, Bibiru or Bebeeru Bark.

Botanical Origin—*Nectandra Rodiæi* Schomburgk—The Bibiru or Greenheart is a large forest tree, growing on rocky soils in British Guiana, twenty to fifty miles inland. It is found in abundance on the hill sides which skirt the rivers Essequibo, Cuyuni, Demerara, Pomeroon and Berbice. The tree attains a height of 80 to 90 feet, with an undivided erect trunk, furnishing an excellent timber which is ranked in England as one of the eight first-class woods for shipbuilding, and is to be had in beams of from 60 to 70 feet long.

History—In 1769, Bancroft, in his *History of Guiana*, called attention to the excellent timber afforded by the *Greenheart* or *Sipeira*. About the year 1835, it became known that Hugh Rodie, a navy surgeon who had settled in Demerara some twenty years previously, had discovered an alkaloid of considerable efficacy as a febrifuge, in the bark of this tree.[1] In 1843, this alkaloid to which Rodie had given the name *bebeerine*, was examined by Dr. Douglas Maclagan; and the following year, the tree was described by Schomburgk under the name of *Nectandra Rodiæi*.[2]

Description—Greenheart bark occurs in long heavy flat pieces, not infrequently 4 inches broad and $\frac{3}{10}$ of an inch thick, externally of a light greyish brown, with the inner surface of a more uniform cinnamon tint and with strong longitudinal striæ. It is hard and brittle; the fracture coarse-grained, slightly foliaceous, and only fibrous in the inner layer. The grey suberous coat is always thin, often forming small warts, and leaving when removed longitudinal depressions analogous to the *spiral furrows* of Flat Calisaya Bark (p. 316), but mostly longer. Greenheart bark has a strong bitter taste, but is not aromatic. Its watery infusion is of a very pale cinnamon brown.

Microscopic Structure—The general features of this bark are very uniform, almost the whole tissue having been changed into thick-walled cells. Even the cells of the corky layer show secondary deposits; the primary envelope has entirely disappeared, and no transition from the suberous coat to liber is obvious.

The prevalent forms of the tissue are the stone-cells and very short bast-fibres, intersected by small medullary rays and crossed transversely by parenchyme or small prosenchyme cells with walls a little less thickened, so as to appear in a transverse section as irregular squares or groups. The only cells of a peculiar character are the sharp-pointed

[1] Halliday, *On the Bebeeru tree of British Guiana, and Sulphate of Bebeerine, the former a substitute for Cinchona, the latter for Sulphate of Quinine.*—*Edinburgh Med. and Surg. Journ.* vol. xl. 1835.

[2] *Hooker's Journ. of Bot.*, 1844. 624.

fibres of the inner liber, which are curiously saw-shaped, being provided with numerous protuberances and sinuosities.

The very small lumen of the thick-walled cells contains a dark brown mass which is coloured greenish-black by sulphate of iron; the same coloration takes place throughout the less dense tissue surrounding the groups of stone-cells, and may in each case be due to tannic matter.

Chemical Composition—Greenheart bark contains an alkaloid which has long been regarded as peculiar, under the name of *Bibirine* or *Bebirine*. It was however shown by Walz in 1860 to be apparently identical with *Buxine*, a substance discovered as early as 1830 in the bark and leaves of the Common Box, *Buxus sempervirens* L. In 1869, the observation of Walz was to some extent confirmed by one of us,[1] who further demonstrated that *Pelosine*, an alkaloid occurring in the stems and roots of *Cissampelos Pareira* L. and *Chondodendron tomentosum* Ruiz et Pavon (p. 27), is undistinguishable from the alkaloids of greenheart and box.

The alkaloid of bibiru bark, which may be conveniently prepared from the crude sulphate used in medicine under the name of *Sulphate of Bibirine*, is a colourless amorphous substance, the composition of which is indicated by the formula, $C^{18}H^{21}NO^3$. It is soluble in 5 parts of absolute alcohol, in 13 of ether, and in 1400 (1800 Walz) of boiling water, the solution in each case having a decidedly alkaline reaction on litmus. It dissolves readily in bisulphide of carbon, as well as in dilute acids. The salts hitherto known are uncrystallizable. The solution of a neutral acetate affords an abundant white precipitate on the addition of an alkaline phosphate, nitrate or iodide, of iodo-hydrargyrate or platino-cyanide of potassium, perchloride of mercury, or of nitric or iodic acid.

Maclagan, one of the earliest investigators of greenheart, has recently obtained in co-operation with Gamgee[2] certain alkaloids from the wood of the tree, to one of which, these chemists have assigned the formula $C^{20}H^{23}NO^4$ and the name *Nectandria*. Two other alkaloids, the characters of which have not yet been fully investigated, are stated to have been obtained from the same source.

Bibiric Acid, which Maclagan obtained from the *seeds*, is described as a colourless, crystalline, deliquescent substance, fusing at 150° C. and volatile at 200° C., then forming needle-shaped groups.

Commerce—The supplies of greenheart bark are extremely uncertain, and the drug is scarcely to be found in the market. It has been imported in barrels containing 80 to 84 lb. each, or in bags holding $\frac{1}{2}$ to $\frac{3}{4}$ cwt.

Uses—The bark has been recommended as a bitter tonic and febrifuge, but is hardly ever employed except in the form of what is called *Sulphate of Bibirine*, which, as we have said, is *crude Sulphate of Buxine*.[3] It is a dark amorphous substance which, having while in a syrupy state been spread out on glazed plates, is obtained in thin translucent laminæ. We find it to yield scarcely one-third of its weight of the pure alkaloid.

[1] Flückiger, *Neues Jahrbuch für Pharmacie*, xxxi. (1869) 257; *Pharm. Journ.* xi. (1870) 192.

[2] *Pharm. Journ.* xi. (1870) 19.

[3] Mr. W. H. Campbell, of Georgetown, Demerara, has assured me that neither the bark nor its alkali is held in esteem in the colony.—D. H.

RADIX SASSAFRAS.

Sassafras Root; F. *Bois de Sassafras, Lignum Sassafras*; G. *Sassafrasholz.*

Botanical Origin—*Sassafras officinale* Nees (*Laurus Sassafras* L.), ee growing in North America, from Canada, southward to Florida and souri. In the north, it is only a shrub, or a small tree 20 to 30 feet h, but in the Middle and Southern United States, and especially in ginia and Carolina, it attains a height of 40 to 50 feet. The leaves of different forms, some being ovate and entire, and others two- or e-lobed, the former it is said, appearing earlier than the latter.

History—Monardes relates that the French during their expedition Florida, about the year 1562, cured their sick with the wood and of a tree called *Sassafras*, the use of which they had learnt from the ians.[1] Laudonnière, who diligently set forth the wonders of Florida, rves that among forest trees, the most remarkable for its timber and cially for its fragrant bark, is that called by the savages *Pavame*, by the French *Sassafras*.[2]

In 1610, a paper of instructions from the Government of England to of the new colony of Virginia, mentions among commodities to be home, "*Small Sassafras Rootes*," which are "to be drawen in the ter and dryed and none to be medled with in the somer;—and yt rorthe £50 and better per tonne."[3] The shipments were afterwards sh overdone, for in 1622, complaint is made that other things than sero and *sassafras*[4] were neglected to be shipped.

The sassafras tree had been introduced into England in the time of arde (*circa* 1597), who speaks of a specimen growing at Bow. At period, the wood and bark of the root were used chiefly in the tment of ague.

Description—Sassafras is imported in large branching logs, which n include the lower portion of the stem, 6 to 12 inches in diameter.[5] roots proper, which diminish in size down to the thickness of a l, are covered with a dull, rough, spongy bark. This bark has an t, soft corky layer, beneath which is a firmer inner bark of brighter , rich in essential oil. The wood of the root is light and easily cut, olour of a dull reddish brown, and with a fragrant odour and spicy e similar to that of the bark but less strong. It is usually sold in shops, rasped into shavings.

The *bark of the root* (*Cortex Sassafras*) is a separate article of merce, but not much used in England. It consists of channelled, ish, or curled, irregular fragments, seldom exceeding 4 inches long inches broad and generally much smaller, and from $\frac{1}{16}$ to $\frac{1}{4}$ of an in thickness. The inert outer layer has been carefully removed, ing a scarred, exfoliating surface. The inner surface is finely striated

[1] *Historia medicinal de las cosas que se de nuestras Indias occidentales*, 1574.

[2] De Laet, *Novus Orbis*, 1633. 215.

[3] *Colonial Papers*, vol. i. No. 23 (MS. in Record Office, London).

[4] *Colonial Papers*, vol. ii No. 4.

[5] The sassafras logs met with in English trade often include a considerable portion of trunk-wood, which, as well as the bark that covers it, is inert, and should be sawn off and rejected before the wood is rasped.

and exhibits very minute shining crystals. The bark has a short, corky fracture, and in colour is a bright cinnamon brown of various shades. It has a strong and agreeable smell, with an astringent, aromatic, bitterish taste.

Microscopic Structure—The wood of the root exhibits in transverse section, concentric rings traversed by narrow medullary rays. Each ring contains a number of large vessels in its inner part, and more densely packed cells in its outer. The prevailing part of the wood consists of prosenchyme cells. Globular cells, loaded with yellow essential oil, are distributed among the woody prosenchyme. The latter as well as the medullary rays abounds in starch.

The *bark* is rich in oil-cells and also contains cells filled with mucilage; it owes its spongy appearance and exfoliation to the formation of secondary cork bands (*rhytidoma*) within the mesophlœum and even in the liber. The cortical tissue abounds in red colouring matter and further contains starch and, less abundantly, oxalate of calcium.

Chemical Composition—The wood of the root yields 1 to 2 per cent. of volatile oil,[1] and the root-bark twice as much. The stem and leaves of the tree contain but a very small quantity. The oil, which is found in commerce is all manufactured in America, has the specific odour of sassafras, and is colourless, yellow, or reddish-brown, according, as the distillers assert, to the character of the root employed. As the colour of the oil does not affect its flavour and market value, no effort is made to keep separate the different varieties of root.

Oil of Sassafras has a sp. gr. of 1·087 to 1·094, increasing somewhat by age (Procter). When cooled in a freezing mixture, it deposits crystals of *Sassafras Camphor*. This body which may be obtained in the form of hard, four- or six-sided prisms with the odour of sassafras, has the composition, $C^{10}H^{10}O^2$; it has a sp. gr. of 1·245, or 1·11 when melted at 12° C. The liquefied crystals solidify at 7° C. and boil at 232° C. The researches of Grimaux and Ruotte[2] show the oil to contain nine-tenths of its weight of *Safrol*, $C^{10}H^{10}O^2$, a liquid boiling between about 230° and 233° C. and having a sp. gr. of 1·114 at 0° C. Safrol has a fennel-like odour and is devoid of rotatory power; it is not soluble in caustic alkalis. Treated with bromine, it yields crystals having the formula, $C^{10}H^5Br^5O^2$, melting at 170° C. Safrol according to these chemists does not solidify even at −20° C. As the composition and boiling point of sassafras camphor agree with those of safrol we suppose that the latter may by time acquire the faculty of congealing on exposure to cold, so that in fact these substances are identical.

Another constituent of sassafras oil has been termed by Grimaux and Ruotte, *Safrene*; it boils at 155 to 157 C., has a sp. gr. of 0·8[illegible] and the formula $C^{10}H^{16}$. It has the same odour as safrol, but deviates the ray of polarized light to the right.

It was further found by the same observers, that the crude oil contains an extremely small quantity of a substance of the phenol class, which can be removed by caustic lye and separated by an acid. The oily aqueous

[1] According to information obtained by Procter, 11 bushels of chips (the charge of a still) yields from 1 to 5 lb. of oil, the amount varying with the quality of the root, and the proportion of bark it may contain.—Procter, *Essay on Sassafras* in the *Proc. of the American Pharm. Association*, 1[illegible] 217.

[2] *Comptes Rendus*, lxvii. (186[illegible]) [illegible]

us obtained, assumes a green hue on addition of perchloride of iron, d separates silver from a boiling solution of its nitrate. The *rsarubin* and *Sassafrin* of Hare (1837) are impure products of the composition of sassafras oil by means of sulphuric acid.

The *bark* and also to some extent the *wood*, in both cases of the root, ntain tannic acid which produces a blue colour with persalts of iron. r oxidation, we must suppose, it is converted into the red colouring atter deposited in the bark and, in smaller quantity, in the heart-wood old trees. The young wood is nearly white. The said red substance obably agrees with that, to which Reinsch in 1845 and 1846 gave the me of *Sassafrid*, and is doubtless analogous to cinchona-red and tanhia-red. Reinsch obtained it to the extent of 9·2 per cent.

Production and Commerce—Baltimore is the chief mart for safras root, bark and oil, which are brought thither from within a cuit of 300 miles. The roots are extracted from the ground by the lp of levers, partly barked and partly sent untouched to the market, or cut up into chips for distillation on the spot. Of the bark, as much 100,000 lb. were received in Baltimore in 1866. The quantity of oil nually produced previous to the war, is estimated at 15,000 to 20,000 lb. ere are isolated small distillers in Pennsylvania and West New Jersey, o are allowed by the owners of a "*sassafras wilderness*," to remove m the ground the roots and stumps without charge. Sassafras root is medicinal in the United States, the more aromatic root-bark being sonably preferred.[1]

Uses—Sassafras is reputed to be sudorific and stimulant, but in itish practice it is only given in combination with sarsaparilla and aiacum. Shavings of the wood are sold to make *Sassafras Tea*.

In America, the essential oil is used to give a pleasant flavour to rvescing drinks, tobacco and toilet soaps.[2]

Substitutes—The odour of sassafras is common to several plants of order *Lauraceæ*. Thus the bark of *Mespilodaphne Sassafras* Meissn., ree of Brazil, resembles in odour true sassafras. We have seen a very ck sassafras bark brought from India, the same we suppose as that ich Mason[3] describes as abundantly produced in Burma.

The large separate cotyledons of two lauraceous trees of the Rio gro, doubtfully referred by Meissner to the genus *Nectandra*, furnish so-called *Sassafras Nuts* or *Puchury* or *Pichurim Beans* of Brazil, asionally to be met with in old drug warehouses.

On the Orinoko and in Guiana, a liquid called *Sassafras Oil* is ained by boring into the stem of *Oreodaphne opifera* Nees, which metimes contains a cavity holding a large quantity of this fluid. A ilar oil (*Aceite de Sassafras*) is afforded on the Rio Negro by *Nectandra alarum* Nees.[4]

[1] Besides this, the *pith of sassafras* is also used as a popular remedy; it is entirely ld of odour and taste, and is very slightly flaginous.

[2] *American Journ. of Pharm.* 1871. 470.

[3] *Burmah, its people and natural productions*, 1860. 497.

[4] Spruce in *Hooker's Journ. of Bot.* vii. (1855) 278.

THYMELEÆ.

CORTEX MEZEREI.

Mezereon Bark; F. *Ecorce de Mézéréon;* G. *Seidelbast-Rinde.*

Botanical Origin—*Daphne Mezereum* L., an erect shrub, 1 to 3 feet high, the branches of which are crowded with purple flowers in the early spring before the full expansion of the oblong, lanceolate, deciduous leaves. The flowers are succeeded by red berries. It is a native of the hilly parts of almost the whole of Europe, from Italy to the Arctic regions, and extends eastward to Siberia. In Britain, it occurs here and there in a few of the southern and midland counties, and even reaches Yorkshire and Westmoreland, but there is reason to think it is not truly indigenous. Gerarde, who was well acquainted with it, did not regard it as a British plant.

History—The Arabian physicians used a plant called *Mázaryón*, the effects of which they compared to those of euphorbium; it was probably a species of *Daphne*. *D. Mezereum* was known to the early botanists of Europe, as *Daphnoides, Chamælæa, Thymelæa,* or *Chamædaphne.* Tragus described and figured it in 1546, under the name of *Mezereum Germanicum.*

Description—Mezereon has a very tough and fibrous bark easily removed in long strips which curl inwards as they dry; it is collected in winter and made up into rolls or bundles. The bark, which rarely exceeds $\frac{1}{16}$ of an inch in thickness, has an external greyish or reddish-brown cork coat which is easily separable from a green inner layer, white and satiny on the side next the wood. That of younger branches is marked with prominent leaf-scars. The bark is too tough to be broken, but easily tears into fibrous strips. When fresh, it has an unpleasant odour which is lost in drying; its taste is persistently burning and acrid. Applied in a moist state to the skin, it occasions after some hours, redness and even vesication.

Microscopic Structure—The cambial zone is formed of about 8 rows of delicate unequal cells. The liber consists chiefly of simple fibres alternating with parenchymatous bundles, and traversed by medullary rays. The fibres are very long,—frequently more than 3 mm., and from 5 to 10 mkm. in diameter, their walls being always but little thickened. In the outer part of the liber, there occur bundles of thick-walled bast tubes, while chlorophyll and starch granules appear generally through the middle cortical layer. The suberous coat is made up of about 8 dense rows of thin-walled tabular cells, which examined in a tangential section, have an hexagonal outline. Small quantities of tannic acid are deposited in the cambial and suberous zones.

Chemical Composition—The acrid principle of mezereon is a resinoid substance contained in the inner bark; it has not yet been examined. The fruits were found by Martius (1862) to contain more than 40 per cent. of a fatty, vesicating oil, which appears to be likewise present in the bark.

The name *Daphnin* has been given to a crystallizable substance obtained by Vauquelin in 1808, from *Daphne alpina,* and afterwards detected by C. G. Gmelin and Baer in the bark of *D. Mezereum.* Zwenger

1860, ascertained it to be a non-volatile glucoside of bitter taste, ing the composition, $C^{31}H^{34}O^{19}$.

When daphnin is boiled with dilute hydrochloric or sulphuric acid, ırnishes *Daphnetin*, $C^{19}H^{14}O^{9}$, described by Zwenger as crystallizing colourless prisms. By dry distillation of an alcoholic extract of ereon bark, the same chemist obtained *Umbelliferone* (p. 287).

Uses—Mezereon taken internally is supposed to be alterative and orific, and useful in venereal, rheumatic and scrofulous complaints; in English medicine it is never now given except as an ingredient of Compound Decoction of Sarsaparilla. An ethereal extract of the c has been introduced (1867) as an ingredient of a powerful ıulating liniment. On the Continent, the bark itself, soaked in egar and water, is applied with a bandage as a vesicant.

Substitutes—Owing to the difficulty of procuring the bark of the t of *D. Mezereum*, the herbalists who supply the London druggists e been long in the habit of substituting that of *D. Laureola* L., an rgreen species, not uncommon in woods and hedge-sides in several ts of England. The *British Pharmacopœia* (1864 and 1867) permits *ter Mezerei* to be obtained indiscriminately from either of these species, l does not follow the London College in insisting on the *bark of the* t alone. That of the stem of *D. Laureola* corresponds in structure h the bark of the true mezereon, but wants the prominent leaf-scars t mark the upper branches of the latter; it is reputed to be somewhat acrid than mezereon bark. The mezereon bark of English trade is r mostly imported from Germany, and seems to be derived from *Mezereum*.

In France, use is made of the stem-bark of *D. Gnidium* L., a shrub wing throughout the whole Mediterranean region as far as Morocco. bark is dark grey or brown, marked with numerous whitish leaf-scars ich display a spiral arrangement, at least in the younger stems. The res themselves, some of which are occasionally met with in the drug, sharply mucronate and very narrow. As to structural peculiarities, bark of *D. Gnidium* has the medullary rays more obvious and more led with tannic matters than those of *D. Mezereum*; but the middle ical layer is less developed. The bark, which is called *Ecorce de ou*, is employed as an epispastic.

ARTOCARPACEÆ.

CARICÆ.

Fructus Caricæ, Fici; Figs; F. *Figues;* G. *Feigen.*

Botanical Origin—*Ficus Carica* L., a deciduous tree, 15 to 20 feet eight, with large rough leaves, forming a handsome mass of foliage. The native country of the fig stretches from the steppes of the tern Aral, along the south and south-west coast of the Caspian Sea ilan, Mazanderan and the Caucasus) through Kurdistan, to Asia Minor Syria. In these countries, the fig-tree ascends into the mountain on, growing undoubtedly wild in the Taurus at an elevation of 4800 [1]

[1] Ritter, *Erdkunde von Asien*, vii. (1844) 2. 544.

The fig-tree is repeatedly mentioned in the Scriptures, where with the vine, it often stands as the symbol of peace and plenty. Neither fig nor vine was known in Greece, the Archipelago and the neighbouring coasts of Asia Minor during the Homeric age, though both were very common in the time of Plato. The fig-tree was early introduced into Italy, whence it reached Spain and Gaul. Charlemagne (A.D. 768–814) ordered its cultivation in Central Europe. It was brought to England in the reign of Henry VIII. by Cardinal Pole, whose trees still exist in the garden of Lambeth Palace. But it had certainly been in cultivation at a much earlier period, for the historian Matthew Paris relates[1] that the year 1257 was so inclement that apples and pears were scarce in England, and that figs, cherries and plums totally failed to ripen.

At the present day, the fig-tree is found cultivated in most of the temperate countries both of the old and new world. Its fruit can only be preserved in those regions where the summer and autumn are very warm and dry.

History—Figs were a valued article of food among the ancient Hebrews[2] and Greeks, as they are to the present day in the warmer countries bordering the Mediterranean.[3] In the time of Pliny many varieties were in cultivation. The Latin word *Carica* was first used to designate the dried fig of Caria, a strip of country in Asia Minor opposite Rhodes, an esteemed variety of the fruit corresponding to the Smyrna fig of modern times.

In a diploma granted by Chilperic II., king of the Franks, to the monastery of Corbie, A.D. 716, mention is made of "*Karigas*," in connexion with dates, almonds and olives, by which we think dried figs (*Caricæ*) were intended.[4] Dried figs were a regular article of trade during the middle ages, from the southern to the northern parts of Europe. In England, the average price between A.D. 1264 and 1398, was about $1\frac{3}{4}d.$ per lb., raisins and currants being $2\frac{3}{4}d.$[5]

Description—A fig consists of a thick, fleshy, hollow receptacle of a pear-shaped form, on the inner face of which grow a multitude of minute fruits. This receptacle, which is provided with an orifice at the top, is at first green, tough and leathery, exuding when pricked a milky juice. The orifice is surrounded and almost closed by a number of thick, fleshy scales, near which and within the fig, the male flowers are situated, but they are often wanting or are not fully developed. The female flowers stand further within the receptacle, in the body of which they are closely packed; they are stalked, have a 5-leafed perianth and bipartite stigma. The ovary which is generally one-celled, becomes when ripe, a minute, dry, hard nut, popularly regarded as a seed.

As the fig advances to maturity, the receptacle enlarges, becomes softer and more juicy, a saccharine fluid replacing the acrid milky sap. It also acquires a reddish hue, while its exterior becomes purple, brown or yellow, though in some varieties it continues green. The fresh fig has

[1] *English History*, Bohn's edition, iii. (1854) 255.

[2] See in particular 1 Sam. xxv. 18 and 1 Chron. xii. 40; where we read of large supplies of dried figs being provided for the use of fighting men.

[3] On the Riviera of Genoa, dried figs and with bread are a common winter food of the peasantry.

[4] Pardessus, *Diplomata, Chartæ*, etc. (1849) 309.

[5] Rogers, *Hist. of Agriculture and Prices in England*, i. (1866) 632.

greeable and extremely saccharine taste, but it wants the juiciness efreshing acidity that characterize many other fruits.

a fig is not gathered, its stalk loses its firmness, the fruit hangs ilous from the branch, begins to shrivel and become more and more arine by loss of water, and ultimately if the climate is favourable, umes the condition of a *dried fig*. On the large scale however, figs ot dried on the tree, but are gathered and exposed to the sun and light trays till they acquire the proper degree of dryness.

ried figs are termed by the dealers, either *natural* or *pulled*. The re those which have not been compressed in the packing, and still their original shape.[1] The second are those which after drying been made supple by squeezing and kneading, and in that state d with pressure into drums and boxes.

myrna figs, which are the most esteemed sort, are of the latter kind. are of irregular, flattened form, tough, translucent, covered with a arine efflorescence; they have a pleasant fruity smell and luscious Figs of inferior quality, as those called in the market *Greek Figs*, chiefly in being smaller and less pulpy.

Microscopic Structure—The outer layer of a dried fig is made up nall, thick-walled and densely packed cells, so as to form a kind of The inner lax parenchyme consists of larger thin-walled cells, rsed by vascular bundles and large, slightly branched, laticiferous ls. The latter contain a granular substance not soluble in water. e parenchyme, stellate crystals of oxalate of calcium occur, but in nsiderable number.

Chemical Composition.—The chemical changes which take place he fig during maturation are important, but no researches have een made for their elucidation. The chief chemical substance in ipe fig is grape sugar, which constitutes from 60 to 70 per cent. e dried fruit. Gum and fatty matter appear to be present only in small quantity. We have observed that unripe figs contain starch.

Production and Commerce—Dried figs were imported into the ed Kingdom in 1872, to the amount of 141,847 cwt., of which 21 cwt. were shipped from Asiatic Turkey, the remainder being from ugal, Spain, the Austrian territories and other countries. The value he total imports is estimated at £231,571.

Uses—Dried figs are thought to be slightly laxative, and as such are sionally recommended in habitual constipation. They enter into the position of *Confectio Sennæ*.

MORACEÆ.

FRUCTUS MORI.

Baccæ Mori, Mora; Mulberries; F. Mûres; G. Maulbeeren.

Botanical Origin—*Morus nigra* L., a handsome bushy tree, about eet in height, growing wild in Northern Asia Minor, Armenia, and southern Caucasian regions as far as Persia. In Italy, it was em-

[1] The word *Eleme* applied in the London to dried figs of superior quality ("Eleme Figs") is probably a corruption of the Turkish *ellémé*, signifying *hand-picked*.

ployed for feeding the silkworm until about the year 1434, when *M. alba* L. was introduced from the Levant,[1] and has ever since been commonly preferred. Yet in Greece, in many of the Greek islands, Calabria and Corsica, the species planted for the silkworm is still *M. nigra*.

The mulberry tree is now cultivated throughout Europe, yet excepting in the regions named, by no means abundantly. It ripens its fruit in England, as well as in Southern Sweden and Gottland, and in favourable summers even in Christiania (Schübeler).

History—The mulberry tree is mentioned in the Old Testament,[2] and by most of the early Greek and Roman writers. Among the large number of useful plants ordered by Charlemagne (A.D. 812) to be cultivated on the imperial farms, the mulberry tree (*Morarius*) did not escape notice.[3] We meet with it also in a plan sketched A.D. 820, for the gardens of the monastery of St. Gall in Switzerland.[4] The cultivation of the mulberry in Spain is implied by a reference to the preparation of *Syrup of Mulberries*, in the Calendar of Cordova[5] which dates from the year 961.

A curious reference to mulberries, proving them to have been far more esteemed in ancient times than at present, occurs in the statutes of the abbey of Corbie in Normandy, in which we find a *Brevis de Mella*, showing how much *honey* the tenants of the monastic lands were required to pay annually, followed by a statement of the quantity of *Mulberries* which each farm was expected to supply.[6]

Description—The tree bears unisexual catkins; the female, of an ovoid form, consists of numerous flowers with green four-lobed perianth and two linear stigmas. The lobes of the perianth overlapping each other become fleshy, and by their lateral aggregation form the spurious berry, which is shortly stalked, oblong, an inch in length, and, when ripe, of an intense purple. By detaching a single fruit, the lobes of the former perianth may be still discerned. Each fruit encloses a hard lenticular nucule, covering a pendulous seed with curved embryo and fleshy albumen.

Mulberries are extremely juicy and have a refreshing, subacid, saccharine taste; but they are devoid of the fine aroma that distinguishes many fruits of the order *Rosaceæ*.

Chemical Composition—In an analysis made by H. van Hees (1857) mulberries yielded the following constituents:—

Glucose and uncrystallizable sugar	9·19
Free acid (supposed to be *malic*)	1·86
Albuminous matter	0·39
Pectic matter, fat, salts, and gum	2·03
Ash	0·57
Insoluble matters (the seeds, pectose, cellulose, &c.)	1·25
Water	84·71
	100·00

[1] A. De Candolle, *Géogr. botanique*, ii. (1855) 856.

[2] 2 Sam. v. 23, 24.

[3] Pertz, *Monumenta Germaniæ historica* (Leges) iii. (1835) 181.

[4] F. Keller, *Baurissa des Klosters St. Gallen*, facsimile, Zurich, 1844.

[5] *Le Calendrier de Cordoue de 961*, publié par R. Dozy, Leyde, 1873, 67.

[6] Guérard, *Polyptique de l'Abbé Irmon*, Paris, ii. 335.

With regard to the results of researches on other edible fruits, made bout the same time in the laboratory of Fresenius, it would appear that e mulberry is one of the most saccharine, being only surpassed by the berry (10·79 of sugar) and grape (10·6 to 19·0).[1] It is richer in sugar an the following, namely :—

Raspberries, yielding	4	per cent. of sugar	and	1·48	of (malic)	acid.
Strawberries	„	5·7	„	„	1·31	„ „
Whortleberries	„	5·8	„	„	1·34	„ „
Currants	„	6·1	„	„	2·04	„ „

The amount of free acid in the mulberry is not small, nor is it excesive. The small proportion of insoluble matters is worthy of notice in omparison, for instance, with the whortleberry which contains no less han 13 per cent. The colouring matter of the mulberry has not been xamined. The acid is probably not simply malic, but in part tartaric.

Uses—The sole use in medicine of mulberries is for the preparation f a syrup, employed to flavour or colour other medicines. In Greece, he fruit is submitted to fermentation, thereby furnishing an inebriating everage.

CANNABINEÆ.

HERBA CANNABIS.

Cannabis Indica ; Indian Hemp ; F. *Chanvre Indien ;* G. *Hanfkraut.*

Botanical Origin—*Cannabis sativa* L., Common Hemp, an annual lioecious plant, native of Western and Central Asia, cultivated in temperate as well as in tropical countries.

It grows wild luxuriantly on the banks of the lower Ural and Volga near the Caspian Sea, extending thence to Persia, the Altai range, and Northern and Western China. It is found in Kashmir and on the Himalaya, growing 10 to 12 feet high, and thriving vigorously at an elevation of 6000 to 10,000 feet. It likewise occurs in Tropical Africa, on the eastern and western coasts as well as in the central tracts watered by the Congo and Zambesi, but whether truly indigenous is doubtful. It has been naturalized in Brazil, north of Rio de Janeiro, the seeds having been brought thither by the negroes from Western Africa. The cultivation of hemp is carried on in many parts of continental Europe, but especially in Central and Southern Russia.

The hemp plant grown in India, exhibits certain differences as contrasted with that cultivated in Europe, which were noticed by Rumphius in the 17th century, and which, at a later date, induced Lamarck to claim for the former plant the rank of a distinct species, under the name of *Cannabis indica*. But the variations observed in the two plants are of so little botanical importance and are so inconstant, that the maintenance of *C. indica* as distinct from *C. sativa* has been abandoned by general consent.

In a medicinal point of view, there is a wide dissimilarity between hemp grown in India and that produced in Europe, the former being mostly more potent. Yet even in India there is much variation, for according to Jameson, the plant grown at altitudes of 6000 to 8000

[1] The fig excepted, which is much more saccharine than any.

feet, affords the resin known as *Charas*, which cannot be obtained that cultivated on the plains.[1]

History—Hemp has been propagated on account of its textile and oily seeds from a remote period.

The ancient Chinese herbal called *Rh-ya*, written about the 5th tury B.C., notices the fact that the hemp plant is of two kinds, th producing seeds, the other flowers only.[2] In the writings of Susr Hindu medicine, supposed to date some centuries before the Chr era, hemp (*B'hangá*) is mentioned as a remedy. Herodotus state hemp grows in Scythia both wild and cultivated, and that the Thr make garments from it which can hardly be distinguished from He also describes how the Scythians expose themselves as in a b the vapour of the seeds thrown on hot coals.[3]

The Greeks and Romans appear to have been unacquainted wit medicinal powers of hemp, unless indeed the care-destroying Νηπ should, as Royle has supposed, be referred to this plant. Accordi Stanislas Julien,[4] anæsthetic powers were ascribed by the Chine preparations of hemp as early as the commencement of the 3rd cen

The employment of hemp both medical and dietetic, appears to spread slowly through India and Persia to the Arabians, amongst v the plant was used in the early middle ages. The famous heretica of Mahomedans, whose murderous deeds struck terror into the h of the Crusaders during the 11th and 12th centuries, derived their of *Hashishin* or, as it is commonly written, *assassins*, from *hashís* Arabic for *hemp*,[5] which in certain of their rites, they used as a toxicant.[6]

The use of hemp (*bhang*) in India was particularly noticed by G d'Orta[7] (1563), and the plant was subsequently figured by Rheede described the drug as largely used on the Malabar coast. It would about this time to have been imported into Europe, at least, occasio for Berlu in his *Treasury of Drugs*, 1690, describes it as coming Bantam in the East Indies, and "*of an infatuating quality and nicious use.*"

It was Napoleon's expedition to Egypt that was the means of calling attention to the peculiar properties of hemp, by the accoun De Sacy (1809) and Rouger (1810). But the introduction of the In drug into European medicine is of still more recent date, and is cl due to the experiments made in Calcutta by O'Shaughnessy in 183

[1] *Journ. of the Agric. and Hortic. Soc. of India*, viii. 167.

[2] Bretschneider, *On Chinese Botanical Works*, 1870. 5. 10. Part of the *Rh-ya* was written in the 12th cent. B.C.

[3] Rawlinson's translation, iii. (1859) book 4, chap. 74-5.

[4] *Comptes Rendus*, xxviii. (1849) 195.

[5] Hence the words *assassin* and *assassinate*. Weil, however, is of opinion that the word *assassin* is more probably derived from *sikkin*, a dagger.—*Geschichte der Chalifen*, iv. (1860) 101.

[6] The miscreant who assassinated Justice Norman at Calcutta, 20 Sept. 1871, is said to have acted under the influence of *hashísh*. Bellew (*Indus to the Tigris*, 1874. 218) states that the Afghan chief who m Dr. Forbes in 1842, had for some day viously been more or less intoxicated *Charas* or *Bhang*.

[7] *Colloquios dos simples e drogas medicinaes da India*, ed. 2, Lisboa, 2f.

[8] For a notice of them, see O'Sh *On the preparation of the Ind or Gunjah*, Calcutta, 1839; also *B pensatory*, Calcutta, 1842. 579 6 immense number of references to wr have touched on the medicinal prop hemp, will be found in the elabora entitled *Studien über den Hanf*, by D Martius (Erlangen, 1855).

lthough the astonishing effects produced in India by the administration preparations of hemp are seldom witnessed in the cooler climate of ritain, the powers of the drug are sufficiently manifest to give it an tablished place in the pharmacopœia.

Production—Though hemp is grown in many parts of India, yet s a drug, it is chiefly produced in a limited area in the districts of ogra and Rájsháhi, north of Calcutta, where the plant is cultivated for e purpose in a systematic manner. The retail sale, like that of opium d spirits, is restricted by a license, which in 1871–2, produced to the overnment of Bengal about £120,000, while upon opium (chiefly conumed in Assam), the amount raised was £310,000.[1] Bhang is one of e principal commodities imported into India from Turkestan.

Description—The leaves of hemp have long stalks with small stipules at their bases, and are composed of 5 to 7 lanceolate-acuminate aflets, sharply serrate at the margin. The loose panicles of male flowers, nd the short spikes of female flowers, are produced on separate plants, om the axils of the leaves. The fruits, called *Hemp-seeds*, are small rey nuts or achenes, each containing a single oily seed. In common ith other plants of the order, hemp abounds in silica which gives a oughness to its leaves and stems. In European medicine, the only emp employed is that grown in India, which occurs in two principal orms, namely:—

1. *Bhang, Siddhí* or *Sabzí* (Hindustani); *Hashísh* or *Qinnab* (Arabic). his consists of the dried leaves and small stalks, which are of a dark reen colour, coarsely broken, and mixed with here and there a few ruits. It has a peculiar but not unpleasant odour, and scarcely any aste. In India, it is smoked either with or without tobacco, but more commonly it is made up with flour and various additions, into a sweetmeat or *majun*,[2] of a green colour. Another form of taking it, is that of n infusion, made by immersing the pounded leaves in cold water.

2. *Ganja* (Hindustani); *Qinnab* (Arabic); *Guaza*[3] of the London rug-brokers. These are the flowering or fruiting shoots of the female lant, and consist in some samples of straight, stiff, woody stems some nches long, surrounded by the upward branching flower-stalks; in thers of more succulent and much shorter shoots, 2 to 3 inches ong, and of less regular form. In either case, the shoots have a compressed and glutinous appearance, are very brittle and of a brownishreen hue. In odour and in the absence of taste, *ganja* resembles hang. It is said that after the leaves which constitute *bhang* have been athered, little shoots sprout from the stem, and that these picked off and ried, form what is called *ganja*.[4]

Chemical Composition—The most interesting constituents of hemp rom a medical point of view, are the *resin* and *volatile oil*.

The former was first obtained in a state of comparative purity by - and H. Smith in 1846.[5] It is a brown amorphous solid, burning with bright white flame and leaving no ash. It has a very potent action

[1] Blue Book quoted at p. 49, note 1.

[2] Father Ange, in his *Pharmacopœia Per-*, 1681, gives numerous formulæ for electaries under the name of *magi-oun*.

[3] This name is not used in India, but seems to be a corruption of *ganja*.

[4] Powell, *Economic Products of the Punjab*, Roorkee, i. (1868) 293.

[5] *Pharm. Journ.* vi. (1847) 171.

when taken internally, two-thirds of a grain acting as a powerful narc and one grain producing complete intoxication. From the experim of Messrs. Smith, it seems to us impossible to doubt that to this n the energetic effects of cannabis are mainly due.

When water is repeatedly distilled from considerable quantitie hemp, fresh lots of the latter being used for each operation, a vol oil lighter than water is obtained, together with ammonia. This according to the observations of Personne (1857), is amber-colou and has an oppressive hemp-like smell. It sometimes deposits abundance of small crystals. With due precautions it may be separ into two bodies, the one of which named by Personne *Cannab* is liquid and colourless, with the formula $C^{18}H^{20}$; the other whic called *Hydride of Cannabene*, is a solid, separating from alcohol in p crystals to which Personne assigns the formula $C^{18}H^{22}$. He asserts cannabene has indubitably a physiological action, and even claims i the sole active principle of hemp. Its vapour he states to produce w breathed, a singular sensation of shuddering, a desire of locomo followed by prostration and sometimes by syncope.[2] Bohlig in 1 observed similar effects from the oil, which he obtained from the f herb just after flowering, to the extent of 0·3 per cent.

The other constituents of hemp are those commonly occurrin other plants. The leaves yield nearly 20 per cent. of ash.

As to the resin of Indian hemp, Bolas and Francis in treating it nitric acid, converted it into *Oxycannabin*, $C^{20}H^{30}N^{2}O^{7}$. This intere substance may, they say, be obtained in large prisms from a solutio methylic alcohol. It melts at 176° C. and then evaporates wit decomposition; it is neutral.[3] One of us (F.) has endeavoured to ol it from the purified resin of charas but without success.

Uses—Hemp is employed as a soporific, anodyne, antispasmodic as a nervous stimulant. It is used in the form of alcoholic ex administered either in a solid or liquid form. In the East it is sumed to an enormous extent by Hindus and Mahomedans, who smoke it with tobacco, or swallow it in combination with substances.[4]

Charas.

No account of hemp as a drug would be complete without notice of this substance, which is regarded as of great importa Asiatic nations.

Charas or *Churrus* is the resin which exudes in minute drops the leaves and branches of the plant. It is collected in several wa one is by rubbing the tops of the plant in the hands when the seed

[1] *Journ. de Pharm.* xxxi. (1857) 48; Canstatt's *Jahresbericht* for 1857, i. 28.

[2] Personne, though he admits the activity of the resin prepared by Smith's process, contends that it is a mixed body, and that a further purification deprives it of all volatile matter and renders it inert. This is not astonishing when one finds that the "purification" was effected by treatment with caustic lime or soda-lime, and exposure to a temperature of 300° C. (572° F.)! That the resin of the Edinburgh chemist not owe its activity to volatile m proved by their own experiment ing a small quantity in a very th to 82° C. for 8 hours: the medi of the resin so treated was found to impaired.

[3] *Chemical News*, xxiv. (1871) 77.

[4] For further information, consult *Seven Sisters of Sleep*. Lond., xvii.

and scraping from the fingers the adhering resin. Another is performed :—men clothed in leather garments walk about among ng hemp, in doing which the resin of the plant attaches itself to ather, whence it is from time to time scraped off. A third method ts in collecting, with many precautions to avoid its poisonous , the dust which is raised when heaps of dry *bhang* are stirred 1

r whichever of these processes obtained, charas is of necessity a nd crude drug, the use of which is properly excluded from civilized ine. As before remarked (p. 492) it is not obtainable from hemp indiscriminately in any situation even in India, but is only to from plants produced at a certain elevation on the hills.

e best charas, which is that brought from Yarkand, is a brown, -looking substance, forming compact yet friable, irregular masses siderable size. Examined under a strong pocket lens, it appears made up of minute, transparent grains of brown resin, agglutinated short hairs of the plant. It has a hemp-like odour, with but little even in alcoholic solution. A second and a third quality of Yar- charas represent the substance in a less pure state. Charas viewed the microscope, exhibits a crystalline structure, due to inorganic r. It yields from ¼ to ⅓ of its weight of an amorphous resin, which dily dissolved by bisulphide of carbon or spirit of wine. The loes not redden litmus, nor is it soluble in caustic potash. It has k brown colour, which we have not succeeded in removing by l charcoal. The residual part of charas yields to water a little de of sodium, and consists in large proportion of carbonate of m and peroxide of iron. These results have been obtained in ning samples from Yarkand.[2] Other specimens which we have xamined, have the aspect of a compact dark resin.

aras is imported from Yarkand[3] and Kashgar, the first of which exported during 1867, 1830 *maunds* (146,400 lb.) to Lé, whence mmodity is carried to the Punjab and Kashmír. Smaller quan- are annually imported from Kandahar and Samarkand.[4] The drug tly consumed by smoking with tobacco ; it is not found in Euro- commerce.

STROBILI HUMULI. *U*

Humulus vel Lupulus ; Hops ; F. *Houblon ;* G. *Hopfen.*

tanical Origin—*Humulus Lupulus* L.,—a diœcious perennial producing long annual twining stems which climb freely over trees ushes. It is found wild, especially in thickets on the banks of throughout all Europe, from Spain, Sicily and Greece to Scandi- and extends also to the Caucasus, the South Caspian region, and

ell, *Economic Products of the Punjab*, , 1868, 293.

ained by Colonel H. Strachey, and he Kew Museum. It is by no means by what process they were collected.

yth, *Correspondence on Mission to Yarkand*, ordered by the House of Commons to be printed, Feb. 28, 1871 ; also Henderson and Hume, *Lahore to Yarkand*, Lond. 1873, 334.

[4] Stewart, *Punjab Plants*, Lahore, 1869. 216.

through Central and Southern Siberia to the Altai mountains. been introduced into North America, Brazil (Rio Grande do S Australia.

History—Hops have been used from a remote period in the of beer, of which they are now regarded as an indispensable in Hop gardens, under the name *humularia* or *humuleta*, are ment existing in France and Germany in the 8th and 9th centuri Bohemian and Bavarian hops have been known as an esteem since the 11th century. A grant alleged to have been made by the Conqueror in 1069, of hops and hop-lands in the county of would indicate, were it free from doubt, a very early cultiv the hop in England.

As to the use made of hops in these early times, it would app they were regarded in somewhat of a medicinal aspect. In the *He of Apuleius*,[2] an English manuscript written about A.D. 1050, it i the hop (*hymele*) that its good qualities are such that men put it usual drinks; and St. Hildegard,[3] a century later, states that (*hoppho*) is added to beverages, partly for its wholesome bittern partly because it makes them keep.

Hops for brewing were among the produce which the tenant abbey of St. Germain in Paris[4] had to furnish to the monaster beginning of the 9th century; yet in the middle of the 14th beer without such addition was still brewed in Paris.

The brewsters, bakers and millers of London were the subj mandate of Edward I. in A.D. 1298; but there is no reason for i that the manufacture of malt liquor at this period involved th hops. It is plain indeed that somewhat later, hops were *not* g used, for in the 4th year of Henry VI. (1425–26), an informat laid against a person for putting into beer "an unwholesome wee *an hopp*;"[5] and in the same reign, Parliament was petitioned "that wicked weed called *hops*."

But it is evident that hops were soon found to possess good q and that though their use was denounced, it was not suppressed in the regulations for the household of Henry VIII. (1530–31), the injunction that the brewer is "not to put any hops or brimstone ale";[6] while in the very same year (1530), hundreds of po Flemish hops were purchased for the use of the noble fa L'Estranges of Hunstanton.[7]

In 1552, the cultivation of hops in England was distinctly sa by the 5th and 6th of Edward VI. c. 5, which directs that land for tillage should again be so cultivated, excepting it should have been *hops* or saffron. Notwithstanding these facts, hops were for a lon hardly regarded an essential in brewing, as may be gathered fr remark of Gerarde (*ob.* A.D. 1607), who speaks of them as used "to beer or ale, explaining that notwithstanding their manifold virtu

[1] Blount, *Tenures of Land and Customs of Manors*, edited by Hazlitt, 1874. 165.

[2] *Leechdoms, Wortcunning and Starcraft of Early England*, edited by Cockayne, i. (1864) 173; ii. (1865) ix.

[3] *Opera Omnia*, accurante J. P. Migne, Paris, 1855. 1153.

[4] Guérard, *Polyptique de l'abbé* i. (1844) 714. 896.

[5] The authority for this statem isolated memorandum in a MS. vol 980) by Thomas Gybbons, preser Harleian collection in the British M

[6] *Archæologia*, iii. (1786) 157.

[7] Ibid. xxv. (1834) 505.

rather make it a physical drinke to keepe the body in health, than an rdinary drinke for the quenching of our thirst." In reality, other herbs ere for a long period employed to impart to malt liquor a bitter or romatic taste, as Ground Ivy (*Nepeta Glechoma* Benth.) anciently called le-hoof or Gill; Alecost (*Balsamita vulgaris* L.); Sweet Gale (*Myrica ale* L.); and Sage (*Salvia officinalis* L.). Even Long Pepper and Bay erries were used for the same purpose,[1] but in addition to hops.

Though English hops were esteemed superior to foreign, and were xtensively grown as early as 1603, as shown by an act of James I.,[2] lemish hops continued to be imported in considerable quantities down 1693.

Structure—The inflorescence of the male plant constitutes a large anicle; that of the female is less conspicuous, consisting of stalked atkins which by their growth develope large leafy imbricating bracts, ltimately forming an ovoid cone or strobile, which is the officinal part. This catkin consists of a short central zigzag stalk, bearing overlapping edimentary leaflets, each represented by a pair of stipules. Between hem are 4 female florets, each supported by a bract. After flowering, he stipules as well as the bracts are much enlarged, and then form the persistent, yellowish-green, pendulous strobile. At maturity, each bract infolds at its base a small lenticular closed fruit or nut, $\frac{1}{10}$ of an inch in iameter. The nut is surrounded by a membranous, one-leafed perigone, nd contains within its fragile, brown shell, an exalbuminous seed. These ruits, as well as the axis and the base of all the leaflike organs, are beset with numerous shining, translucent glands, to which the aromatic smell nd taste of hops are due.

Description—Hops as found in commerce, consist entirely of the ully developed strobiles or cones, more or less compressed. They have a greenish yellow colour, an agreeable and peculiar aroma, and a bitter romatic burning taste. When rubbed in the hand they feel clammy, nd emit a more powerful odour. By keeping, hops lose their greenish olour and become brown, at the same time acquiring an unpleasant odour, y reason of the formation of a little valerianic acid. Exposure to the apour of sulphurous acid retards or prevents this alteration. For edicinal use, hops smelling of sulphurous acid should be avoided, hough in reality the acid speedily becomes innocuous. Liebig has efuted the objections raised by brewers to the sulphuring of hops.

Chemical Composition—Besides the constituents of the glands hich are described in the next article, hops contain 3 to 5 per cent. of a annin, stated by Wagner to resemble *Morintannic Acid*; also chlorohyll, gum, from 5 to 9 per cent. of ash constituents, chiefly potassium alts, and about 12 per cent. of water.

Siewert (1870) has analysed six specimens of hops grown in Germany which he found the resin soluble in alcohol, to vary from 9·7 to 18·4 r cent.

The odour of hops resides in an essential oil, of which the yield from 1 to 2 per cent. Personne found the oil to contain *Valerol*, $H^{10}O$, which passes into valerianic acid; the latter in fact occurs in

[1] Holinshed, *Chronicles*, vol. i. book 2. [2] 1 James I. (anno 1603) cap. 18.

the glands, yet according to Méhu[1] only to the extent of 0·1 to 0·17 per cent. When distilled from the fresh strobiles the oil has a greenish colour, but a reddish-brown when old hops have been employed. We find it to be devoid of rotatory power, neutral to litmus paper, and not striking any remarkable coloration with concentrated sulphuric acid.

Griessmayer (1874) has shown that hops contain *Trimethylamine*, and in small proportion, a liquid volatile alkaloid not yet analysed, which he terms *Lupuline*. The latter is stated to have the odour of conine, and to assume a violet hue when treated with chromate of potassium and sulphuric acid.

Production and Commerce—England was estimated as having in 1873, 63,276 acres under hops. The chief district for the cultivation is the county of Kent, where in that year 39,040 acres were devoted to this plant. Hops are grown to a much smaller extent in Sussex, and in still diminished quantity in Herefordshire, Hampshire, Worcestershire and Surrey. The other counties of England, and the principality of Wales produce but a trifling amount, and Scotland none at all.

In continental Europe, hops are most largely produced in Bavaria and Wurtemberg, Belgium and France, but in each on a smaller scale than in England. France in 1872 is stated to have 9223 acres under hops.[2]

Notwithstanding the extensive production of hops in England, there is a large importation from other countries. The importation in 1872 was 135,965 cwt., valued at £679,276: of this quantity, Belgium supplied 66,930 cwt., Germany 36,612 cwt., Holland 16,675 cwt., the United States 10,414 cwt., France 5328 cwt. During the same period, hops were exported from the United Kingdom to the extent of 31,215 cwt.[3]

Uses—Hops are administered medicinally as a tonic and sedative, chiefly in the form of tincture, infusion or extract.

GLANDULÆ HUMULI.

Lupulina; Lupulin, Lupulinic Grains; F. *Lupuline;* G. *Hopfendrüsen, Hopfenstaub.*

Botanical Origin—*Humulus Lupulus* L. (see preceding article). The minute, shining, translucent glands of the strobile, constitute when detached therefrom, the substance called *Lupulin.*

History—The glands of hop were separated and chemically examined by L. A. Planche, a pharmacien of Paris, whose observations were first briefly described by Loiseleur-Deslongchamps in 1819.[4] In the following year, Dr. A. W. Ives of New York published[5] an account of his experiments upon hops and their glands, to which latter he applied the name of *Lupulin.* Payen and Chevallier, Planche and others, made further experiments on the same subject, endorsing the recommendation of Ives that lupulin (or, as they preferred to call it, *Lupuline*) might be advantageously used in medicine in place of hops.

Production—Lupulin is obtained by stripping off the bracts of hops

[1] *Thèse*, Montpellier, 1867.

[2] *Agricultural Returns of Great Britain*, &c., 1873, presented to Parliament, 48. 49. 70. 71.

[3] *Annual Statement of the Trade of the United Kingdom* for 1872. 49. 93.

[4] *Manuel des Plantes usuelles et indigènes*, 1819. ii. 503.

[5] Silliman's *Journ. of Science*, ii. (1820) 302.

ıd shaking and rubbing them; and then separating the powder by a eve. The powder thus detached, ought to be washed by decantation, as to remove from it the sand or earth with which it is always con-ıminated; finally it should be dried, and stored in well-closed bottles. rom the dried strobiles, 8 to 12 per cent. of lupulin may be obtained.

Description—Lupulin seen in quantity appears as a yellowish-rown granular powder, having an agreeable odour of hops and a bitter omatic taste. It is gradually wetted by water, instantly by alcohol or her, but not by potash or sulphuric acid. By trituration in a mortar, e cells are ruptured so that it may be worked into a plastic mass. hrown into the air and then ignited, it burns with a brilliant flame like ycopodium.

Microscopic Structure—The lupulinic gland or grain, like the enerality of analogous organs, is formed by an intumescence of the rticle of the nuculæ and bracts of hop (see p. 497). Each grain is riginally attached by a very short stalk, which is no longer perceptible n the drug. The gland, exhausted by ether and macerated in water, is globular or ovoid thin-walled sac, measuring from 140 to 240 mkm. t consists of two distinct, nearly hemispherical parts; that originally rovided with the stalk is built up of tabular polyhedric cells, whilst the pper hemisphere shows a continuous delicate membrane. This part herefore easily collapses, and thus exhibits a variety of form, the greater lso as the grains turn pole or equator to the observer.[1]

The hop gland is filled with a thick, dark brown or yellowish liquid, hich in the drug is contracted into one mass occupying the centre of he gland. It may be expelled in minute drops when the wall is made o burst by warming the grain in glycerin. The colouring matter, to hich the wall owes its fine yellow colour, adheres more obstinately to he thinner hemisphere, and is more easily extracted from the thicker art by means of ether.

Chemical Composition—The odour of lupulinic grains resides in he essential oil, described in the previous article. The bitter principle rmerly called *Lupulin* or *Lupulite* was first isolated by Lermer (1863) who alled it the *bitter acid of hops* (*Hopfenbittersäure*). It crystallizes in large ittle rhombic prisms, and possesses in a high degree the peculiar bitter ste of beer, in which however it can be present only in very small roportion, it being nearly insoluble in water though easily dissolved by any other liquids. The composition of this acid, $C^{32}H^{50}O^{7}$, appears to pproximate it to absinthiin; it is contained in the glands in but small roportion. Still smaller is the amount of another crystallizable con-tituent, regarded by Lermer as an alkaloid.

The main contents of the hop gland consist of wax (*Myricylic nitate*, according to Lermer), and resins, one of which is crystalline nd unites with bases.

A good specimen of German lupulin, dried over sulphuric acid, yielded 7·3 per cent. of ash. The same drug exhausted by boiling ether, orded 76·82 per cent. of an extremely aromatic extract, which on posure to the steam bath for a week, lost 3·03 per cent., this loss corre-

[1] For a full account of the formation of glands, see Trécul, *Annales des Sciences t. Bot.*, i. (1854) 299. An abstract may be found in Méhu's *Etude du Houblon et du Lupulin*, Montpellier, 1867.

sponding to the volatile oil and acids. The residual part was sc glacial acetic acid and could therefore contain but very little fatty

Uses—The drug has the properties of hops, but with astringency. It is not often prescribed.

Adulteration—Lupulin is apt to contain sand, and on inci often leaves a large amount of ash. Other extraneous matte are not unfrequent, may be easily recognized by means of a le the essential oil in lupulin is soon resinified, the latter should ferred fresh, and should be kept excluded from the air.

ULMACEÆ.

CORTEX ULMI.

Elm Bark; F. *Ecorce d'Orme;* G. *Ulmenrinde, Rüsterrinc*

Botanical Origin—*Ulmus campestris* Smith, the Common stately tree, widely diffused over Central, Southern and Eastern extending in Norway to 66° N. lat.; southward to Northern Af Asia Minor, and eastward as far as Amurland, Northern Chi Japan. It is probably not truly indigenous to Great Britain; Wych Elm, *U. montana* With., is certainly wild in the north western counties.[1]

History—The classical writers, and especially Dioscoride familiar with the astringent properties of the bark of πτελέα, b name *Ulmus campestris* is understood. Imaginary virtues are by Pliny to the bark and leaves of *Ulmus.* Elm bark is fre prescribed in the English Leech Books of the 11th century, a period a great many plants of Southern Europe had alread introduced into Britain.[2] Its use is also noticed in Turner's (1568) and in Parkinson's *Theater of Plants* (1640), the autho latter remarking, that "all the parts of the Elme are of much Physicke."

Description—Elm bark for use in medicine should be remov the tree in early spring, deprived of its rough corky outer coat, a dried. Thus prepared, it is found in the shops in the form c flattish pieces, of a rusty yellowish colour, and striated surface es on the inner side. It is tough and fibrous, nearly inodorous, an woody, slightly astringent taste.

Microscopic Structure—The liber which is the only offici consists of thick-walled, tangentially extended parenchyme, in there are some larger cells filled with mucilage, while the rest c red-brown colouring matter. The mucilage forms a stratified within the cell. Large bast-bundles arranged in irregular rows, al with the parenchyme and are intersected by narrow, reddish, me rays consisting of 2 or 3 rows of cells. The bast-bundles

[1] On the word *elm*, Dr. Prior remarks that it is nearly identical in all the Germanic and Scandinavian dialects, yet does not find its root in any of them, but is an adaptation of the Latin *Ulmus.*—*Popular Names of British Plants*, ed. 2. 1870. 71.

[2] *Leechdoms, Wortcunning and of Early England*, edited by Cockayne, ii (1865) pp. 53. 67. 79 and p. xii.—In the Anglo-Saxon re *Elm* and *Wych Elm* are named.

s long tubes about 30 mkm. thick, with narrow cavities; and these, somewhat larger tubes with porous transverse walls m vessels). Each cubic cell of the neighbouring bast-paren- encloses a large crystal, seldom well defined, of oxalate of

nistry—The chief soluble constituent of elm bark is mucilage mall proportion of tannic acid. The concentrated decoction brown precipitate with perchloride of iron; the dilute assumes oloration with that test. Starch is wanting, or only occurs in le cortical layer which is usually rejected.

in summer-time frequently exude a gum which, by contact with s converted into a brown insoluble mass, called *Ulmin*. This s been extended to various decomposition-products of organic e nature and affinities of which are but little known.[1]

—Elm bark is prescribed in decoction as a weak mucilaginous t, but is almost obsolete.

CORTEX ULMI FULVÆ.

Slippery Elm Bark.

nical Origin—*Ulmus fulva* Michaux, the Red or Slippery Elm, r middle-sized tree, seldom more than 30 to 40 feet high, grow- e banks of streams in the central and northern United States stern New England to Wisconsin and Kentucky, and found anada.

ory—The Indians of North America attributed medicinal virtues rk of the Slippery Elm, which they used as a healing application s, and in decoction as a wash for skin diseases. Bigelow writing remarks that the mucilaginous qualities of the inner bark are vn.

ription—The Slippery Elm Bark used in medicine consists of only. It forms large flat pieces, often 2 to 3 feet long by ches broad, and usually $\frac{1}{20}$ to $\frac{2}{20}$ of an inch thick, of an ex- ough and fibrous texture. It has a light reddish-brown colour, resembling that of fenugreek (which is common to the leaves a simply mucilaginous taste.

lecting the bark the tree is destroyed, and no effort is made to , the wood being nearly valueless. Thus the supply is dimin- ar by year, and the collectors who formerly obtained large s of the bark in New York and other eastern states, have now tward for supplies.[2]

oscopic Structure—The transverse section shows a series of g layers of large yellowish bundles of soft liber fibres, alter- th small brown parenchymatous bands. The whole tissue is by numerous narrow medullary rays, and interrupted by large lar mucilage-ducts. In order to examine the latter, longitu- ions ought to be moistened with benzol, aqueous liquids causing ration. In a longitudinal section, the mucilage-ducts are seen o 100 mkm. long, and to contain colourless masses of mucilage,

[1] *Chemistry*, xvii. (1866) 458.

[2] *Proceedings of the American Pharmaceutical Association for* 1873, xxi. 435.

distinctly showing a series of layers. Crystals of calcium oxalate, as well as small starch grains, are very plentiful throughout the surrounding parenchyme, but not in the mucilage-ducts.

Chemical Composition—The most interesting constituent of the bark is the mucilage, which is imparted to either cold or hot water but does not form a true solution. The bark moistened with 20 parts of water swells considerably, and becomes enveloped by a thick neutral mucilage, which is not altered either by iodine or perchloride of iron. This mucilage when diluted even with a triple volume of water, will yield only a few drops when thrown on a paper filter. The liquid which drains out is precipitable by neutral acetate of lead. By addition of absolute alcohol, the concentrated mucilage is not rendered turbid, but forms a colourless transparent fluid deposit.

Uses—Slippery Elm Bark is a demulcent like althæa or linseed. The powder[1] is much used in America for making poultices; it is said to preserve lard from rancidity, if the latter is melted with it and kept in contact for a short time.

EUPHORBIACEÆ.

EUPHORBIUM.

Euphorbium, Gum Euphorbium; F. *Gomme-résine d'Euphorbe*; G. *Euphorbium*.

Botanical Origin—*Euphorbia resinifera* Berg, a leafless, glaucous, perennial plant resembling a cactus, and attaining 6 or more feet in height. Its stems are ascending, fleshy and quadrangular, each side measuring about an inch. The angles of the stem are furnished at intervals with pairs of divergent, horizontal, straight spines about ¼ of an inch long, and confluent at the base into ovate, subtriangular discs. These spines represent stipules: above each pair of them is a depression, indicating a leaf-bud. The inflorescence is arranged at the summits of the branches, on stalks each bearing three flowers, the two outer of which are supported on pedicels. The fruit is tricoccous, $\frac{3}{10}$ of an inch wide, with each carpel slightly compressed and keeled.

The plant is a native of Morocco, growing on the lower slopes of the Atlas in the southern province of Suse. Dr. Hooker and his fellow travellers met with it in 1870, at Imsfuia, south-east of the city of Morocco, which appears to be its westward limit.

History—Euphorbium was known to the ancients. Dioscorides[2] and Pliny[3] both describe its collection on Mount Atlas in Africa, and notice its extreme acridity. According to the latter writer, the drug received its name in honour of Euphorbus, physician to Juba II., king of Mauritania. This monarch, who after a long reign died about A.D. 18, was distinguished for his literary attainments, and was the author of several books[4] which included treatises on opium and euphorbium. The latter work was apparently extant in the time of Pliny.

Euphorbium is mentioned by numerous other early writers on medi-

[1] That sold in America is sometimes adulterated with farinaceous substances.

[2] Lib. iii. c. 86.

[3] Lib. v. c. 1; lib. xxv. c. 38.

[4] Smith, *Dict. of Greek and Roman Biography*, ii. (1846) 636.

Rufus Ephesius, who probably flourished during the reign of y Galen in the 2nd century, and by Vindicianus and Oribasius h. Aëtius and Paulus Ægineta, who lived respectively in the 7th centuries, were likewise acquainted with it; and it was also › the Arabian school of medicine. The drug has a place in all printed pharmacopœias.

›lant yielding euphorbium was first described at the beginning esent century, by an English merchant named Jackson, who had ıany years in Morocco. From the figures he published,[1] the 'as doubtfully identified with *Euphorbia Canariensis* L., a large ;e shrub, abounding on scorched and arid rocks in the Canary

e year 1849, it was pointed out in the (*Admiralty*) *Manual of Enquiry*, that the stems of which fragments are found in com- uphorbium, do not agree with those of *E. Canariensis*. Berg ıe comparison further, and finally from the fragments in ques- v up a botanical description which with an excellent figure, he l[2] as *Euphorbia resinifera*. The correctness of his observations fully justified by specimens[3] which were transmitted to the ırdens, Kew, in 1870, and now form flourishing plants.

:ction—Euphorbium is obtained by making incisions in the shy branches of the plant. These incisions occasion an abun- ıdation of milky juice which hardens by exposure to the air, ıg the stems down which it flows; it is finally collected in the rt of the summer. So great is the acridity of the exudation, collector is obliged to tie a cloth over his mouth and nostrils, to the entrance of the irritating dust. The drug is said to be in districts lying east and south-east of the city of Morocco.

:ription—The drug consists of irregular pieces, seldom more inch across and mostly smaller, of a dull yellow or brown waxy- ıubstance, among which, portions of the angular spiny stem of may be met with. Many of the pieces encrust a tuft of spines er-stalk or are hollow. The substance is brittle and translucent; examined under the microscope exhibit no particular structure, the aid of polarized light; nor are starch granules visible. The slightly aromatic, especially if heat is applied; but 10 lb. of the ch we subjected to distillation, afforded no essential oil. Euphor- › a persistent and extremely acrid taste; its dust excites violent and if inhaled, as when the drug is powdered, occasions alarming ıs.

nical Composition—An analysis of euphorbium performed by ;,[4] showed the composition of the drug to be as follows:—

t of the Empire of Morocco and of Suse, Lond. 1809. 81. pl. 7.—represents an entire plant, and purports to be a portion of a the natural size. The latter is figure of a different species,—that which has been recently Cosson, *Euphorbia Beaumierana*, nd Schmidt, *Offizinelle Gewächse*, txxiv. d.

[3] They were procured by Mr. William Grace, and forwarded to England by Mr. C. F. Carstensen, British Vice-Consul at Mogador.

[4] Flückiger in Wittstein's *Vierteljahrsschrift für prakt. Pharmacie*, xvii. (1868) 82-102.—The drug analysed consisted of selected fragments, free from extraneous substances.

Amorphous resin, $C^{20}H^{32}O^{4}$	38
Euphorbon, $C^{26}H^{44}O^{2}$	22
Mucilage	18
Malates, chiefly of calcium and sodium ...	12
Mineral compounds	10
	100

The amorphous resin is readily soluble in cold spirit of wine containing about 70 per cent. of alcohol. The solution has no acid reaction, but an extremely burning acrid taste: in fact it is to the amorphous indifferent resin that euphorbium owes its intense acridity.

This constituent having been removed, ether takes up the *Euphorbon*, which may be obtained in colourless, although not very distinct crystals, which are at first not free from acrid taste. But by repeated crystallizations and finally boiling in a weak solution of permanganate of potassium, they may be so far purified as to be entirely tasteless. Euphorbon is insoluble in water; it requires about 60 parts of spirit of wine, sp. gr. 0·830, for solution at the ordinary temperature. In boiling spirit of wine, euphorbon dissolves abundantly, also in ether, benzol, amylic alcohol, chloroform, acetone, or glacial acetic acid.

Euphorbon melts at 116° C., without emitting any odour. By dry distillation, a brownish oily liquid is obtained, which claims further examination. If euphorbon dissolved in alcohol is allowed to form a thin film in a porcelain capsule, and is then moistened with a little oil of vitriol, a fine violet hue is produced in contact with strong nitric acid slowly added by means of a glass rod. The same reaction is displayed by *Lactucerin* (p. 356), to which in its general characters euphorbon is closely allied.

As to the mucilage of euphorbium, it may be obtained from that portion of the drug which has been exhausted by cold alcohol and by ether. Neutral acetate of lead, as well as silicate or borate of sodium, precipitate this mucilage, which therefore does not agree with gum arabic.

If an aqueous extract of euphorbium is mixed with spirit of wine, and the liquid evaporated, the residual matter assumes a somewhat crystalline appearance and exhibits the reactions of *Malic Acid*. Subjected to dry distillation, white scales and acicular crystals of *Maleic* and *Fumaric Acids*, produced by the decomposition of the malic acid, are sublimed into the neck of the retort. A sublimate of the same kind may sometimes be obtained directly by heating fragments of euphorbium. Among the mineral constituents of the drug, chloride of sodium and calcium are noticeable; scarcely any salt of potassium is present.

Commerce—The drug is shipped from Mogador. The quantity imported into the United Kingdom in 1870, is given in the *Annual Statement of Trade*, as 12 cwt.

Uses—Euphorbium was formerly employed as an emetic and purgative, but as an internal remedy it is completely obsolete. We have been told that it is now in some demand as an ingredient of a paint for the preservation of ships' bottoms.

CORTEX CASCARILLÆ.

leutheriæ; Cascarilla Bark, Sweet Wood Bark, Eleuthera Bark[1]; F. *Ecorce de Cascarille*; G. *Cascarill-Rinde.*

nical Origin—*Croton Eluteria* Bennett,[2] a shrub or small tree, f the Bahama Islands.

ory—It is not improbable that cascarilla bark was imported ope in the first half of the 17th century, as there was much se subsequent to the year 1630 between England and the s.[3]

his as it may, the earliest notice of the bark with which we are ed, is that of Stisser, a physician and professor of Helmstedt in ck, who relates that he received the drug under the name of *leuterii* from a person who had returned from England, in which he was assured, it was customary to mix it with tobacco for the correcting the smell of the latter when smoked. He also s that it had been confounded with Peruvian Bark, from which it was very distinct in odour, &c.[4]

Stisser, and Apinus a physician of Hersbruck near Nuremberg, as others, prescribed this bark as a febrifuge; and soon afterwards to be confounded with cinchona bark and to be used in the that then rare medicine.[5] Hence the name *cascarilla*, signifying ish *little bark*, which was the customary designation of Peruvian as erroneously applied to the Bahama bark, until at last it quite led the original and more correct appellation.[6] The bark was roduced into the London Pharmacopœia in 1746, as *Eleutheriæ* which was its common name among druggists down to the end of century. In the Bahamas, the name *cascarilla* is still hardly the bark being there called either *Sweet Wood Bark*, or *Eleu- ark*.

plant affording cascarilla has been the subject of much discussion, chiefly from the circumstance that several nearly allied West species of *Croton*, yield aromatic barks resembling more or less cinal drug. Catesby in 1754, figured a Bahama plant, *Croton la* Bennett, from which the original *Eleuthera Bark* was pro- erived, though it certainly affords none of the cascarilla of commerce. Woodville in 1794, and Lindley in 1838, both ated the botany of the subject, the latter having the advantage

Eleuthera, one of the Bahama o named from the Greek ἐλεύθερος, *free* or *independent*. *al of Proceedings of Linn. Soc.* iv. t. 29.

at year, a patent was granted by . for the incorporation of a Com- colonizing the Bahama Islands, plete record is extant of the pro- of the Company for the first eleven s existence. In some of the docu- rticular mention is made of the in- a, actual or attempted, of useful cotton, tobacco, fig, pepper, pome- palma Christi, mulberry, flax, indigo, madder, and jalap; and there is also frequent allusion to the importation of the produce of the islands, but no mention of *Cascarilla*. See *Calendar of State Papers*, Colonial Series, 1574 1660, edited by Sainsbury, Lond. 1860. pp. 146. 148. 149. 164. 168. 185, &c.

[4] Stisser (J. A.) *Actorum Laboratorii Chemici specimen secundum*, Helmestadii, 1693. c. ix.

[5] Geoffroy, *Tract. de Mat. Med.*, ii. (1741) 202

[6] Murray, *Apparatus Medicaminum*, iv. (1787) 128; Martiny, *Encyklopadie der Rohwaarenkunde*, i (1843) 271.

of authentic specimens communicated by the Hon. J. C. Lees of New Providence, to whom one of us is also indebted for a similar favour. The question was not however, finally set at rest until 1859, when J. J. Bennett by the aid of specimens collected in the Bahamas by Daniell in 1857-8, drew up lucid diagnoses of the several plants which had been confounded, and disentangled their intricate synonymy.[1]

Description—Cascarilla occurs in the form of tubular or channelled pieces of a dull brown colour, somewhat rough and irregular, rarely exceeding 4 inches in length by ½ an inch in diameter. The chief bulk of that at present imported, is in very small thin quills and fragments, often scarcely an inch in length, and evidently stripped from very young wood. The younger bark has a thin suberous coat easily detached, blotched or entirely covered with the silvery-white growth of a minute lichen (*Verrucaria albissima* Ach.), the perithecium of which appears as small black dots. The older bark is more rugose, irregularly tessellated by longitudinal cracks and less numerous transverse fissures. Beneath the corky envelope, the bark is greyish-brown.

The bark breaks readily with a short fracture, the broken surface displaying a resinous appearance. It has a very fragrant odour, especially agreeable when several pounds of it are reduced to coarse powder and placed in a jar; it has a nauseous bitter taste. When burned, it emits an aromatic smell, and hence is a common ingredient in fumigating pastilles.

Microscopic Characters—The suberous coat is made up of numerous rows of tabular cells, the outermost having their external walls much thickened. The mesophlœum exhibits the usual tissue containing starch, chlorophyll, essential oil, crystals of oxalate of calcium and a brown colouring matter. The latter assumes a dark bluish coloration on addition of a persalt of iron. The liber consists of parenchyma and of fibrous bundles, intersected by small medullary rays. On the transverse section, the fibrous bundles show a wedge-shaped outline; they are for the most part built up, not of true liber fibres, but of cylindrical cells having their transverse walls perforated sieve-like (*cribriformia*). The contents of the parenchymatous part of the liber are the same as in the mesophlœum; as to the oxalate of calcium, the variety of its crystals is remarkable.

Chemical Composition—Cascarilla contains a volatile oil, which it yields to the extent of ¾ to 1 per cent. According to Völckel, the first portion which comes over is colourless, mobile and refractive, the next yellowish and rather viscid, and the last of all, very thick. The chemist regards the crude oil as a mixture of at least two oils, the most volatile of which is probably free from oxygen.[2] Gladstone (1872) assigns to the hydrocarbon of cascarilla oil, the composition of oil of turpentine. Rectified oil of cascarilla, distilled by one of us some years ago, deviated the ray of polarized light 2·9° to the left, when observed in a column 50 mm. long.

The bark afforded to Trommsdorff, 15 per cent. of resin consisting of two portions,—the one *acid* (*i.e.* soluble in alkalis), the other indifferent. It appears to contain gum in about the same proportion.

[1] Bennett, l.c.; also Daniell in *Pharm. Journ.* iv. (1863) 144. 226, with figures.

[2] Gmelin, *Chemistry*, xiv. (1860) 363.

bitter principle was isolated in 1845 by Duval, and called *lin*. C. and E. Mylius (1873) have obtained it from a deposit fficinal extract, in microscopic prisms readily soluble in ether alcohol, very sparingly in water, chloroform or spirit of wine. ı at 205° C., is not volatile, nor a glucoside. Its composition to the formula $C^{12}H^{18}O^{4}$.

ımerce—The bark is shipped from Nassau, the chief town of rovidence (Bahamas), and is usually packed in sacks. The r imported into the United Kingdom in 1870 was 12,261 cwt., ıs £16,482.

s—Cascarilla is prescribed as a tonic, usually in the form of or infusion.

ılteration—A spurious cascarilla bark has lately been noticed in don market; it was imported from the Bahamas mixed with the , to which it bears a close similarity. The quills of it resemble er quills of cascarilla; though covered with a lichen, the latter ; the silvery whiteness of the *Verrucaria* of cascarilla. The ı bark has a suberous coat that does not split off; its inner is pinkish-brown, and distinctly striated longitudinally. In ɔpic structure the bark may be said to resemble cascarilla and re copalchi. But it is at once distinguishable by its numerous ı *groups* of sclerenchymatous cells, which become very evident ıin sections are moistened with ammonia, and then with solution ıe in iodide of potassium. The bark has an astringent taste, bitterness or aroma; its tincture is not rendered milky by ı of water, but is darkened by ferric chloride,—in these respects ; from a tincture of cascarilla. Mr. Holmes[1] suggests that this ı cascarilla is probably the bark of *Croton lucidus* L.

Copalchi Bark.

ı drug is derived from *Croton niveus* Jacquin (*C. Pseudo-China* t.), a shrub growing 10 feet high, native of the West Indian Mexico, New Granada and Venezuela. It has occasionally been d into Europe, in quills a foot or two in length, usually much and thicker than those of cascarilla, to which in odour and taste y approximates. The bark has a thin, greyish, papery, suberous hich when removed shows the surface marked with minute trans- ts, like the lines made by a file; it has a short fracture.

alchi bark was examined by J. Eliot Howard,[2] and found to con- minute proportion of a bitter alkaloid soluble in ether, which ed quinine in yielding a deep green colour when treated with ı and ammonia, though it did not afford any characteristic com- vith iodine. Mauch[3] who also analysed the bark, could not obtain any organic base. He extracted by distillation the essential oil, ıe found to consist of a hydrocarbon and an organic acid,—the ot examined; he likewise got from the bark an uncrystallizable rinciple, which proved to be not a glucoside.

ıı. *Journ.* April 11, 1874, 810.
ıı. *Journ.* xiv. (1855) 319.
[3] Wittstein's *Vierteljahresschrift für prakt. Pharm.*, xviii. (

SEMEN TIGLII.

Semen Crotonis; Croton Seeds; F. *Graines de Tilly ou des Molu Petits Pignons d'Inde;* G. *Purgirkörner, Granatill.*

Botanical Origin—*Croton Tiglium* L. (*Tiglium officinale* Kl a small tree, 15 to 20 feet high, indigenous to the Malabar Co Tavoy, cultivated in gardens in many parts of the East, from Ma to the Indian Archipelago. The tree has small inconspicuous f and brown, capsular, three-celled fruits, each cell containing on The leaves have a disagreeable smell and nauseous taste.

History—In Europe, the seeds and wood of the tree we described in 1578 by Christoval Acosta,—the former, with a fi the plant, appearing under the name of *Piñones de Maluco.*[1] Th was also described and figured by Rheede (1679)[2] and Rumphius (The seeds, which were officinal in the 17th century but had l obsolete, were recommended about 1812, by English medical offi India,[4] and the expressed oil by Perry, Frost, Conwell and other 1821–24. The oil then in use was imported from India, and wa of doubtful purity, so that some druggists felt it necessary to pr seeds for themselves.[5]

Description—Croton seeds are about half an inch long, by $\frac{2}{3}$ of an inch broad, ovoid or bluntly oblong, divided longitudinal two unequal parts, of which the more arched constitutes the dor the flatter the ventral side. From the hilum, a fine raised line (passes to the other end of the seed, terminating in a darker indicating the chalaza. The surface of the seed is more or less c with a bright cinnamon-brown coat, which when scraped shows th brittle, black testa filled with a whitish, oily kernel, invested delicate seed-coat. The kernel is easily split into two halves con of oily albumen, between which lie the large, veined, leafy coty and the radicle. The taste of the seed is at first merely oleagin soon becomes unpleasantly and persistently acrid.

Microscopic Structure—The testa consists of an outer l radially arranged, much elongated and thick-walled cells; the parenchymatous layer contains small vascular bundles. The soft of the albumen is loaded with drops of fatty oil. If this is remo means of ether and weak potash lye, there remain small gran albuminoid matter, the so-called *Aleuron*, and crystals of oxa calcium.

Chemical Composition—The principal constituent of croto is the fatty oil, the *Oleum Crotonis* or *Oleum Tiglii* of pharm

[1] *Tractado de las drogas y medicinas de las Indias Orientales*, Burgos, 1578, c. 48.—After speaking of the virtues of the seeds, he adds—"tambien las buenas mugeres de aquellas partes, amigas de sus maridos, les dã hasta quatro destos por la boca, para embiar a los pobretos al otro mundo."

[2] *Hortus Malabaricus*, ii. tab. 33.

[3] *Herbarium Amboinense*, iv. tab. 42.

[4] Ainslie, *Mat. Med. of Hindostan*, 292.

[5] The oil was very expensive. I the books of Messrs Allen and H that the seeds cost in 1824, 10s. to 18s. per lb. The oil was purchase by the same house at 8s. to 10s per D H.

h the kernels afford from 50 to 60 per cent. That used in England r the most part expressed in London, and justly regarded as more ble than that imported from India, with which the market was erly supplied. It is a transparent, sherry-coloured, viscid liquid, tly fluorescent, and having a slight rancid smell and an oily, acrid . Its solubility in alcohol (·794) appears to depend in great measure he age of the oil, and the greater or less freshness of the seeds from h it was expressed,—oxidized or resinified oil dissolving the most ily.[1] We found the oil which one of us had extracted by means of lphide of carbon, to be levogyre.

Although croton oil does not solidify in contact with nitrous acid, thickens somewhat upon exposure to the air, it does not appear to ain the fatty acid of a true drying oil such as that of linseed. It con- s however in the form of glycerides, several of the members of the fatty s series ($C^nH^{2n}O^2$), such as stearic, palmitic, myristic and lauric acids; largely the more volatile acids, as acetic, butyric and valerianic. volatile part of the acids yielded by croton oil, contains more- r about a third of its weight of an acid which was regarded by lippe (1858) as angelic acid, but which has been shown by Geuther Frölich (1869) to be a peculiar body, metameric with angelic acid, ting at 64° C. and boiling at 201° C. This constituent of croton oil alled by the latter chemists, *Tiglinic Acid;* it has the formula H^8O^2.

Schlippe also found in croton oil a peculiar liquid acid termed *Crotonic d*, $C^4H^6O^2$. According to Geuther and Frölich however, an acid of formula does not occur at all in croton oil, but may be obtained ficially by means of perchloride of phosphorus and ethyldiacetic . They give it the name of *Quartenylic Acid*, instead of *crotonic* . The latter name has been bestowed upon a crystallizable acid, ting at 72° C. and boiling at 187° C., which has been artificially luced by Will and Körner (1863), Wislicenus (1869), and other mists.

The drastic principle of croton oil has not yet been isolated. It ears to exist not only in the seeds, but also in the wood and leaves he plant, from which latter it may possibly be more readily extracted. lippe asserts that he has separated the vesicating matter of croton according to his statements, if the oil be agitated with alcoholic , and afterwards with water, the supernatant liquor will be found e free from acridity, while the alcoholic solution will yield, on ition of hydrochloric acid, a small quantity of a dark brown oil, d *Crotonol*, $C^{18}H^{28}O^4$, possessing strong vesicating properties. In its st state it is described to be a viscid, non-volatile, yellowish liquid, faint peculiar odour, miscible with alcohol or ether, and decom- ble by acids as well as by alkalis. We have not succeeded in ining it, nor, so far as we know, has any other chemist except its overer.

The shells of the seeds (testa) yield upon incineration 2·6 per cent. sh; the kernels dried at 100° C. 3·0 per cent.

Commerce—The shipments of croton seeds arrive chiefly from

[1] Warrington, *Pharm. Journ.* vi. (1865) 382-387.

Cochin or Bombay, packed in cases, bales or robbins; but there a statistics to show the extent of the trade.

Uses—Croton seeds are not administered. The oil is given inter as a powerful cathartic, and is applied externally as a rubefacient.

Substitutes—The seeds of *Croton Pavanæ* Hamilton, a nati Ava and Camrup (Assam), and those of *C. oblongifolius* Roxb., a tree common about Calcutta, are said to resemble those of *C. Tiglia* but we have not compared them. Those of *Baliospermum monta* Müll. Arg. (*Croton polyandrum* Roxb.) partake of the nature of c seeds, and according to Roxburgh, are used by the natives of India purgative.

SEMEN RICINI.

Semen Cataputiæ majoris; Castor Oil Seeds, Palma Christi Seeds F. *Semence de Ricin*; G. *Ricinussamen.*

Botanical Origin—*Ricinus communis* L., the castor oil plant native of India where it bears several ancient Sanskrit names.[1] cultivation, it has been distributed through all the tropical and ma the temperate countries of the globe. In the regions most favoura its growth, it attains a height of 40 feet. In the Azores, and the w Mediterranean countries as Algeria, Egypt and Greece, it beco small tree, 10 to 15 feet high; while in France, Germany and the of England, it is an annual herb of noble foliage, growing to a hei 4 or 5 feet. In good summers, it ripens seeds in England and e far north as Christiania in Norway.

Ricinus communis exhibits a large number of varieties, seve which have been described and figured as distinct species. M after a careful examination of the whole series, maintains them single species, of which he allows 16 forms, more or less well ma Baillon[3] follows the same course.

History—The castor oil plant was known to Herodotus who it Κίκι, and states that it furnishes an oil much used by the Egy At the period when he wrote, it would appear to have been al introduced into Greece, where it is cultivated to the present day the same ancient name.[4] The *Kikajon* of the Book of Jonah, ren by the translators of the English Bible, *gourd*, is believed to be the plant. Κίκι is also mentioned by Strabo as a production of Egy oil from which is used for burning in lamps and for unguents.

Theophrastus and Nicander give the castor oil plant the na Κρότων. Dioscorides, who calls it Κίκι or Κρότων, describes it the stature of a small fig-tree, with leaves like a plane, and seed prickly pericarp, observing that the name Κρότων is applied t seed on account of its resemblance to an insect [*Ixodes Ricinus* l known by that appellation. He also gives an account of the p for extracting castor oil (Κίκινον ἔλαιον), which he says is not food, but is used externally in medicine; he represents the see

[1] The most usual is *Eranda* or *Yeranda*, which passes into several other languages.

[2] De Candolle, *Prodromus*, xv. sect. 2. 1017.

[3] *Hist. des Plantes*; *Euphorbiacées* 110.

[4] Heldreich, *Nutzpflanzen Griechen* Athen, 1862. 58.

purgative. There is a tolerably correct figure of *Ricinus* in s MS. Dioscorides which was executed for the Empress Juliana A.D. 505, and is now preserved in the Imperial Library at

istor oil plant was cultivated by Albertus Magnus, Bishop of in the middle of the 13th century.[1] It was well known as a ant in the time of Turner (1568), who mentions the oil as *inum vel ricininum*.[2] Gerarde at the end of the same century, iar with it under the name of *Ricinus* or *Kik*. The oil he lled *Oleum cicinum* or *Oleum de Cherua*, and used externally seases.

this period the oil seems to have fallen into complete neglect, ; even noticed in the comprehensive and accurate *Pharmacologia* 693). In the time of Hill (1751) and Lewis (1761) Palma eds were rarely found in the shops, and the oil from them was nown.[3]

64, Peter Canvane, a physician who had practised many years 'est Indies, published a "*Dissertation on the Oleum Palmæ ive Oleum Ricini; or (as it is commonly call'd) Castor Oil,*"[4] ecommending its use as a gentle purgative. This essay which rough two editions and was translated into French, was by several others,[5] thus thoroughly drawing attention to the the oil. Accordingly we find that the seeds of *Ricinus* were to the London Pharmacopœia of 1788, and directions given ring oil from them. Woodville in his *Medical Botany* (1790) the oil as having "*lately come into frequent use*."

is period and for several years subsequently, the small supplies of and oil required for European medicine, were obtained from This oil was gradually displaced in the market by that in the East Indies: the rapidity with which the consumption , may be inferred from the following figures, representing the the Castor Oil shipped to Great Britain from Bengal in eral years, namely 1813–14, £610; 1815–16, £1269; 1819–20,

ription—The fruit of *Ricinus* is a tricoccous capsule, usually with weak prickles, containing one seed in each of its three he seeds attain a length of $\frac{3}{10}$ to $\frac{6}{10}$, and a maximum breadth an inch, and are of a compressed ellipsoid form. The apex of

etabilibus, ed. Jessen, 1867. 347.
's Herbal, pt. ii. 116.
ist. of the Mat. Med., Lond. 1751.
, *Hist. of the Mat. Med.*, Lond.

rd *castor* in connection with the oil of *Ricinus*, has come to us ica, in which island, by some stake, the plant was once called *tus*. The true Agnus Castus *us-castus* L.) is a native of the ean countries and not of the West

ist of which consult Mérat et De *de Mat. Méd.*, vi. (1834) 95.
nall was the traffic in Castor Oil in those days, may be judged from the fact that the stock in 1777, of a London wholesale druggist (Joseph Gurney Bevan, predecessor of Allen and Hanburys) was 2 Bottles (1 Bottle = 18 to 20 ounces) valued at 8s. per bottle. The accounts of the same house show at stocktaking in 1782, 23 Bottles of the oil, which had cost 10s. per bottle. In 1799, Jamaica exported 236 Casks of Castor Oil and 10 Casks of seeds (Renny, *Hist. of Jamaica*, 1807. 235).

[7] H. H. Wilson, *Review of the External Commerce of Bengal from 1813 to 1828*, Calcutta 1830, tables pp. 14–15. (We have reduced the value from Sicca rupees to sterling.)

the seed is prolonged into a short beak, on the inner side of v large tumid caruncle: from this latter proceeds the raphe as lower end of the ventral surface, where it forks, its point of c ance through the testa being marked by a minute protuberanc caruncle is broken off, a black scar formed of two little de remains.

The shining grey epidermis is beautifully marked with bands and spots, and in this respect exhibits a great variety c and markings. It cannot be rubbed off, but may after mace peeled off in leathery strips. The black testa, grey withi thicker than in croton seed, but is much more brittle. The nucleus fills the testa completely, and is easily separated, stil by the soft white inner membrane.

The kernel in respect to structure and situation of the embr exactly with that of *Croton Tiglium* (p. 508), excepting that t what gaping cotyledons of *Ricinus* are proportionately broader, their thick midrib provided with 2 or 3 pairs of lateral veins rancid, the kernel has a bland taste, with but very slight acridit

Microscopic Structure—The thin epidermis consists of pe or hexagonal porous tabular cells, the walls of which are pene certain spots by brownish colouring matter, whence the markings on the seed. It is these cells only that become b when a thin tangential slice is saturated with solution of ferric in alcohol.

Beneath these tabular cells, there is found in the unripe see of encrusted colourless cells, deposited in a radial direction on t In the mature seed this layer of cells is not perceptible, and appears to perish as the seed ripens. The testa itself is bu cylindrical, densely packed cells, 300 to 320 mkm. long, and mkm. in diameter. The kernel shares the structure of that of C. but is devoid of crystals of oxalate of calcium. If the er of *Ricinus* is moistened with dilute sulphuric acid, acicular c sulphate of calcium separate from it after a few hours.

When thin slices of the kernel are examined under con glycerin, no drops of oil are visible, notwithstanding the abu this latter; and it becomes conspicuous only by addition of mu Hence it is probable that the oil exists in the seed as a compound with its albuminoid contents.[2] As to the latter, th form in the albumen of *Ricinus*, beautiful octohedra or te which are also found in many other seeds.

Chemical Constitution—The most important constituen seed is the fixed oil, called *Castor Oil*, of which the peeled afford at most, half of their weight.

The oil, if most carefully prepared from peeled and winnow by pressure without heat, has but a slightly acrid taste, and only a very small proportion of the still unknown drastic const

[1] Gris, *Annales des Sciences Nat.*, Bot., xv. (1861) 5–9.

[2] Sachs, *Lehrbuch der Botanik*, 1870. 53.

[3] For further particulars, see Trécul, *Ann. des Sc. Nat.*, Bot., x. (1858) 355; Radlkofer. *Krystalle proteinartiger Körper* 1859 61. and tab. 2 fig. 10; P *teinkörner* in Pringsheim's *Ju wissenschaftliche Botanik*, viii. 464.

: seeds. Hence, the seeds themselves, or an emulsion prepared with :m, act much more strongly than a corresponding quantity of oil. stor oil, extracted by absolute alcohol or by bisulphide of carbon, :ewise purges much more vehemently than the pressed oil.

The castor oil of commerce has a sp. gr. of about 0·96, usually a le yellow tint, a viscid consistence, and a very slight yet rather awkish odour and taste. Exposed to cold, it does not in general tirely solidify until the temperature reaches −18° C. In thin layers it ies up to varnish-like film.

Castor oil is distinguished by its power of mixing in all proportions th glacial acetic acid or absolute alcohol. It is even soluble in four rts of spirit of wine (·838) at 15° C., and mixes without turbidity with equal weight of the same solvent at 25° C. The commercial varieties the oil however, differ considerably in these as well as in some other ıpects.

The optical properties of the oil demand further investigation, as we ve found that some samples deviate the ray of polarized light to the ;ht and others to the left.

By saponification, castor oil yields several fatty acids, one of which pears to be *Palmitic Acid.* Another acid (peculiar to the oil), is *cinoleic Acid*, $C^{18}H^{34}O^3$; it is solid below 0° C. does not solidify in ıtact with the air by absorption of oxygen, and is not homologous th oleic or linoleic acid, neither of which is found in castor oil.[1] stor oil is nevertheless thickened if 6 parts of it are warmed with part of starch and 5 of nitric acid (sp. gr. 1·25), *Ricinelaïdin* being ıs formed. From this, *Ricinelaïdic Acid* may easily be obtained in lliant crystals.

As to the albuminoid matter of the seed, Fleury (1865) obtained :3 per cent. of nitrogen which would answer to about 20 per cent. of :h substances. The same chemist further extracted 46·6 per cent. of ed oil, 2·2 of sugar and mucilage, besides 18 per cent. of cellulose.

According to Bower,[2] the seeds contain a protein substance and a ly resembling amygdalin, by the mutual reaction of which in the :sence of water, there is produced in very small quantity, a fœtid sonous substance which strongly attacks the digestive organs. These tements require investigation.

Tuson in 1864, by exhausting castor oil seeds with boiling water, ained from them an alkaloid which he named *Ricinine.* He states t it crystallizes in rectangular prisms and tables, which when heated e, and upon cooling solidify as a crystalline mass; the crystals may n be sublimed. Burnt on platinum foil, they leave no residue. :inine dissolves readily in water or alcohol, less freely in ether or ızol. Concentrated sulphuric acid dissolves it without coloration. th mercuric chloride, it combines to form tufts of silky crystals, uble in water or alcohol. Heated with potash, it evolves ammonia. :inine is said to have but little taste, and not to be the purgative nciple of the seeds. Werner (1869) on repeating Tuson's process on lb. of Italian castor oil seeds, also obtained a crop of crystals, which appearance and solubility had many of the characters ascribed to inine, but differed in the essential point that when incinerated they

[1] Gmelin, *Chemistry*, xvii. (1866) 131 144. [2] *Am. Journal of Pharm.*, xxvi. (1854) 207.

left a residuum of magnesia. When heated with potash, they gav no ammonia; Werner regarded them as the magnesium salt of a acid. Tuson[1] repudiates the suspicion that ricinine may be iden with Werner's magnesium compound. E. S. Wayne of Cincinnati recently (1874) found in the leaves of *Ricinus*, a substance appare identical with Tuson's ricinine; but he considers that it has no clai be called an alkaloid.

The testa of castor oil seeds afforded us 10·7 per cent. of ash, tenth of which we found to consist of silica. The ash of the ke previously dried at 100° C., amounts to only 3·5 per cent.

Production and Commerce—Castor oil is most extensively duced in India, where two varieties of the seeds, the large and the sn are distinguished, the latter being considered to yield the better prod In manufacturing the oil, the seeds are gently crushed between rol and freed by hand from husks and unsound grains. At Calcutta, parts of seed yield on an average 70 parts of cleaned kernels, whic the hydraulic press afford 46 to 51 per cent. of their weight of oil; oil is afterwards subjected to a very imperfect process of purificatio heating it with water.[2]

The exports of castor oil from Calcutta[3] in the year 1870- amounted to 654,917 gallons, of which 214,959 gallons were shippe the United Kingdom. The total imports of castor oil into the Un Kingdom[4] in the year 1870, were returned as 36,986 cwt. (about 416 gallons), valued at £82,490. Of this quantity, British India (ch Bengal) furnished about two-thirds; and Italy 11,856 cwt. (about 133 gallons), while a small remainder is entered as from "other parts."

Italian Castor Oil, which has of late risen into some celebrit pressed from the seed of plants grown chiefly about Verona and Le in the north of Italy. The manufactory of Mr. Bellino Valeri at latter town produced in the year 1873, 1200 quintals of castor oil, ent from Italian seed. Two varieties of *Ricinus* are cultivated in localities, the black-seeded Egyptian and the red-seeded American latter yields the larger percentage, but the oil is not so pale in co The seeds are very carefully deprived of their integuments, and ha been crushed, are submitted to pressure in powerful hydraulic pr placed in a room which in winter is heated to about 21° C. The ou of oil is further promoted by plates of iron warmed to 32–38° C., placed between the press-bags. The peeled seeds yield about 4 cent. of oil.[5]

All the castor oil pressed in Italy is not pressed from Italian By an official return[6] it appears that in the years 1872–73, there exported from Bombay to Genoa 1350 cwt. of castor oil seeds, le 2452 gallons of castor oil. There are no data to show what wa ported from the other presidencies of India in that year.

Uses—Castor oil is much valued as a mild and safe purgative: v

[1] *Chemical News*, xxii. (1870) 229.

[2] *Madras Exhibition of Raw Products, etc. of Southern India*,—Reports by the Juries, Madras, 1856. 28.

[3] *Annual Volume of Trade and Navigation for the Bengal Presidency for* 1870–71, Calcutta, 1871. 119.

[4] *Annual Statement of the Trade of the U.K. for* 1870.—No later returns

[5] H. Groves, *Pharm. Journ.* viii. 250.

[6] *Annual Statement of the Trade and Navigation of the Presidency of Bombay* 1872–73, part ii. 87. 88.

e commoner qualities are used in soap-making, and in India for burning lamps. The seeds are not now administered. The *leaves* of the nt applied in decoction to the breasts of women, are said to promote even to occasion the secretion of milk. This property which has long en known to the inhabitants of the Cape Verd Islands[1] was particularly observed by Dr. McWilliam about the year 1850. It has even en found that the galactagogue powers of the plant are exerted when e leaves are administered internally.

KAMALA.

Kamela, Glandulæ Rottleræ.

Botanical Origin—*Mallotus Philippinensis* Müll. Arg. (*Croton ilippense* Lam., *Rottlera tinctoria* Roxb., *Echinus Philippinensis* illon), a large shrub, or small tree, attaining 20 or 30 feet in height, very wide distribution. It grows in Abyssinia and Southern Arabia, roughout the Indian peninsulas, ascending the mountains to 5000 feet ove the sea-level, in Ceylon, the Malay Archipelago, the Philippines, stern China and in North Australia, Queensland and New South Wales.

The tricoccous fruits of many of the *Euphorbiaceæ* are clothed with ickles, stellate hairs, or easily removed glands. This is especially the se in the several species of *Mallotus*, most of which have the capsules vered with stellate hairs, together with small glands. In that der notice, the capsule is closely beset with ruby-like glands which, ten removed by brushing and rubbing, constitute the powder known the Bengali name of *Kamala*. These glands are not confined the capsule, but are scattered over other parts of the plant, especially ong the dense tomentum with which the under side of the leaf covered.

History—This drug is mentioned by some of the Arabian physicians[2] early as the 10th century, under the name of *Kunbil* or *Wars*. Ibn urdâdbah, an Arab geographer, living A.D. 869–885, states that from men come striped silks, ambergris, *wars*, and gum.[3] It is described be a reddish yellow powder like sand, which falls on the ground in valleys of Yemen, and is a good remedy for tapeworm and cutaneous eases. One writer compares it to powdered saffron; another speaks two kinds,—an Abyssinian which is *black* (or violet), and an Indian ich is *red*. Abul-Abbas el-Nebâti, who was a native of Spain, remarks t the drug is known in the Hejaz and brought from Yemen, but that s unknown in Andalusia and does not grow there.

In modern times, we find Niebuhr[4] speaks of the same substance "*wars*") stating it to be a dye-stuff, of which quantities are conveyed m Mokha to Oman. The drug must have been long known in India, it has several Sanskrit names: one of these is *Kapila*, which as well the Telugu *Kápila-podi*, is sometimes used by Europeans, though not

[1] Frezier, *Voyage to the South Seas*, Lond. 7. p. 13.—Turner in his Herbal (1568) s the plant an opposite character, for the ised leaves, says he, "swage the brestes ppes swellinge wyth to muche plenty of ke."

[2] Quoted by Ibn Baytar,—see Sontheimer's translation, ii. (1842) 326, 585.

[3] Ibn Khordadbeh, *Livre des routes et des provinces*, trad. par Barbier de Meynard.—*Journ. Asiatique*, v. (1865) 295.

[4] *Description de l'Arabie*, 1774. 133.

so frequently as the word *Kamala* or *Kamela*, which belongs to the Hindustani, Bengali and Guzratti languages.

It does not appear that as a drug the glandular powder of *Mallotus*, or as it is more conveniently called, *Kamala*, attracted any particular notice in Europe until a very recent period, though it is named by Ainslie, Roxburgh, Royle and Buchanan, the last of whom gives an interesting account of its collection and uses.[1] In 1852, specimens of it as found in the bazaar of Aden under the old Arabic name of *Wars*, were sent to one of us by Port-Surgeon Vaughan, with information as to its properties as a dye for a silk and as a remedy in cutaneous diseases.[2] But the real introduction of the drug as a useful medicine is due to Mackinnon, surgeon in the Bengal Medical Establishment, who administered it successfully in numerous cases of tapeworm. Anderson of Calcutta, C. A. Gordon, and Corbyn in India, and Leared in London, confirmed the observations of Mackinnon, and fully established the fact that kamala is an efficient tænifuge.[3] It was introduced into the *British Pharmacopœia* in 1864.

Production—Kamala is one of the minor products of the Government forests in the Madras Presidency, but is also collected in many other parts of India. The following particulars have been communicated to us by a correspondent[4] in the North-west Provinces:—

". . . Enormous quantities of *Rottlera tinctoria* are found growing at the foot of these hills, and every season numbers of people, chiefly women and children, are engaged in collecting the powder for exportation to the plains. They gather the berries in large quantities and throw them into a great basket in which they roll them about, rubbing them with their hands so as to divest them of the powder, which falls through the basket as through a sieve, and is received below on a cloth spread for the purpose. This powder forms the *Kamala* of commerce, and is in great repute as an anthelmintic, but is most extensively used as a dye. The adulterations are chiefly the powdered leaves, and the fruit-stalks with a little earthy matter, but the percentage is not large. The operations of picking the fruit and rubbing off the powder commence here in the beginning of March and last about a month. . . ."

The powder is collected in a similar manner in Southern Arabia whence it is shipped to the Persian Gulf and Bombay. It is also brought under the name of *Wars*, from Hurrur, a town in Eastern Africa, which is a great trading station between the Galla countries and Berbera.[5]

Description—Kamala is a fine, granular, mobile powder, consisting of transparent, crimson granules, the bright colour of which is mostly somewhat deadened by the admixture of grey stellate hairs, minute fragments of leaves and similar foreign matter. It is nearly destitute of taste and smell, but an alcoholic solution poured into water emits a melon-like odour. Kamala is scarcely acted on by water, even at a boiling heat; on the other hand, alcohol, ether, chloroform or benzol extract from it a splendid red resin. Neither sulphuric nor nitric acid

[1] *Journey through Mysore, Canara*, etc., Lond. 1807, i. 168. 211, ii. 343.
[2] *Pharm. Journ.* xii. (1853) 386. 589.
[3] *Ibid.* xvii. (1858) 408.
[4] F. E. G. Matthews, Esq., of Naini Tal.
[5] Burton, *Journ. of R. Geogr. Soc.* xxv. (1855) 146.

upon it in the cold, nor does oil of turpentine become coloured by nless warmed. It floats on water, but sinks in oil of turpentine. en sprinkled over a flame, it ignites after the manner of lycopodium. ted alone, it emits a slight aromatic odour; if pure, it leaves after neration, about 1·37 per cent. of a grey ash.

Microscopic Structure—The granules of kamala are irregular rical glands, 50 to 60 mkm. in diameter; they have a wavy surface, somewhat flattened or depressed on one side, and enclose within their cate yellowish membrane, a structureless yellow mass in which are edded numerous, simple, club-shaped cells containing a homogeneous, sparent, red substance. These cells are grouped in a radiate manner ind the centre of the flattened side, so that on the side next the rver, 10 to 30 of them may easily be counted, while the entire gland contain 40 to 60. In a few cases, a very short stalk-cell is also seen he centre of the base.

When the glands are exhausted by alcohol and potash, and broken pressure between flat pieces of glass, they separate into individual which swell up slightly, while the membranous envelope is comely detached, and appears as a simple coherent film. After this tment the cells, but not their membranous envelope, acquire by onged contact with strong sulphuric acid and iodine water, a more ess brown or blue colour: the walls of the cells alone correspond efore to cellulose. Vogl (1864) supposes that a cell of the epidermis he fruit first developes a young cellule, which by partition is resolved the stalk-cell and the true mother-cell of the small clavate resinules. At first, the contents of the latter do not differ from the mass which they are imbedded, and perhaps pass gradually into resin by amorphosis of the cellular substance.

The glands of kamala are always accompanied by colourless or rnish, thick-walled, stellate hairs, two or three times as long as the ds, often containing air, which do not exhibit any peculiarity of but resemble the hairs of other plants, as *Verbascum* or *Althæa*.

Chemical Composition—Kamala has been analysed by Anderson Glasgow (1855) and by Leube (1860). From the labours of these nists, it appears that the powder yields to alcohol or ether nearly 80 cent. of resin. We find it to be soluble also in glacial acetic acid or isulphide of carbon, not in petroleum ether. By treatment of the extracted by ether with cold alcohol, Leube resolved it into two le reddish yellow resins, of which the one termed *resin α.* is more y soluble and fuses at 80° C., and the other called *resin β.* dissolves readily and fuses at 191° C. Both dissolve in alkaline solutions and be precipitated by acids without apparent change. Leube assigns esin *α.* the composition $C^{30}H^{9}O^{8}$, and to Resin *β.* $C^{16}H^{6}O^{10}$.

Anderson found that a concentrated ethereal solution of kamala red to stand for a few days, solidified into a mass of granular crystals, h by repeated solution and crystallization in ether, were obtained in te of purity. This substance, named by Anderson *Rottlerin*, forms te, platy, yellow crystals of a fine satiny lustre, readily soluble in r, sparingly in cold alcohol, more so in hot, and insoluble in water. mean of four analyses gave the composition of rottlerin as $C^{22}H^{5}O^{6}$.

No definite compound of the substance with a metallic oxide (obtained.

We have been able to confirm the foregoing observations s that we have once obtained an abundance of minute acicular cry: allowing an ethereal solution of kamala to evaporate spontaneou syrupy state. But the purification of these crystals which was att by our friend Mr. T. B. Groves,[1] was unsuccessful, for when fre the protecting mother-liquor, they underwent a change and a an amorphous form. With many samples of kamala we find crystals whatever can be obtained by evaporation of an ethereal s such was also the experience of Leube, who was led from it to q the existence of rottlerin. Kamala contains traces of citric and acids, gum, and volatile oil, besides about 3 per cent. of hygr water.

Uses—The drug is administered for the expulsion of tapew has also been used as an external application in *herpes circinnat* India it is employed for dyeing silk a rich orange-brown.

Adulteration—Kamala is very liable to adulteration with substances, even to the extent of 60 per cent. This contaminatio easily be known by the grittiness of the drug, and by a portion of it s when it is stirred up with water, but in the most decisive man incineration. Sometimes kamala contains an undue proportion of vegetable matter, as remains of the capsules, leaves, &c., which can be separated by a lawn sieve.

Substitute—A very remarkable form of kamala was imported years ago from Aden by Messrs. Allen and Hanburys, druggi London.[2] It arrived neatly packed in oblong, white calico bags, o sizes, each inscribed with Arabic characters, indicating with the n the vendor or collector, the net weight, which was either 100, 50, Turkish ounces.

The drug was in coarser particles than ordinary kamala, of a purple and had a distinct odour resembling that which is produced a tincture of common kamala is poured into water. It had bee fully collected and was free from earthy admixture, yet it left incineration 12 per cent. of ash. Under the microscope, it pre still greater differences, the grains being cylindrical or subconic to 200 mkm. long, by 70 to 100 mkm. broad, with *oblong* resin arranged perpendicularly in three or four storeys; mixed wi grains were a few long, simple hairs. Another fact of some inte that at a temperature of 93° to 100° C., this kamala becomes black, while common kamala undergoes no change of colour.

No information as to the place of production of this drug co obtained, nor more than two supplies, in all 136 ℔. There can b doubt that it is derived from a species of *Mallotus*, but whether I Arabian or African, is a point on which there is no evidence. Th the kindness of Mr. Binnendyk of the Botanical Garden at Buit in Java, we have been enabled to examine the fruits of num species of *Mallotus* (*Rottlera*), and those of *Calodepas*, *Mapp*

[1] *Yearbook of Pharmacy*, 1872. 599.

[2] It has been particularly described by one of us in *Pharm. Journ.* ix. 185 with wood-cuts.

loradenia; but not one of them bears glands resembling those under tice. We have also examined the specimens of *Rottlera* in the Kew rbarium, and consulted Dr. Müller of Geneva, author of the memoir *Euphorbiaceæ* in the *Prodromus* of De Candolle, but without disvering any clue to the name of the plant supplying the drug under tice.

PIPERACEÆ.

FRUCTUS PIPERIS NIGRI.

iper nigrum; Black Pepper; F. *Poivre noir;* G. *Schwarzer Pfeffer.*

Botanical Origin.—*Piper nigrum* L.—The pepper plant is a erennial climbing shrub, with jointed stems branching dichotomously, id broadly ovate, 5- to 7-nerved, stalked leaves. The slender flowerikes are opposite the leaves, stalked and from 3 to 6 inches long; and e fruits are sessile and fleshy.

Piper nigrum is indigenous to the forests of Travancore and Malabar, hence it has been introduced into Sumatra, Java, Borneo, the Malay eninsula, Siam, the Philippines and the West Indies.

History.—Pepper[1] is one of the spices earliest used by mankind, nd although now a commodity of but small importance in comparison ith sugar, coffee and cotton, it was for many ages the staple article f trade between Europe and India.

In the 4th century B.C., Theophrastus noticed the existence of two inds of pepper (πέπερι), probably the *Black Pepper* and *Long Pepper* f modern times. Dioscorides stated pepper to be a production of ndia, and was acquainted with *White Pepper* (λευκὸν πέπερι). Pliny's nformation on the same subject is curious; he tells us that in his time pound of long pepper was worth 15, of white 7, and of black pepper *denarii;* and expresses his astonishment that mankind should so ighly esteem pepper, which has neither a sweet taste nor attractive ppearance, or any desirable quality besides a certain pungency.

In the Periplus of the Erythrean Sea, written about A.D. 64, it is ated that pepper is exported from Baraké, the shipping place of elkunda, in which region, and there only, it grows in great quanty. These have been identified with places on the Malabar Coast etween Mangalore and Calicut.[2]

Long pepper and Black pepper are among the Indian spices on hich the Romans levied duty at Alexandria about A.D. 176.[3]

Cosmas Indicopleustes,[4] a merchant and in later life a monk, who rote about A.D. 540, appears to have visited the Malabar Coast, or at ll events had some information about the pepper plant from an eyeitness. It is he who furnishes the first particulars about it, stating

[1] The word *pepper*, which with slight vaations has passed into almost all languages, mes from the Sanskrit name for *Long pper, pippali*, the change of the *l* into *r* ving been made by the Persians, in whose ident language the *l* is wanting.

[2] Vincent, *Commerce and Navigation of the Ancients*, ii. (1807) 458.

[3] Vincent, op. cit. ii. (1807) 754; also Meyer, *Geschichte der Botanik*, ii. (1865) 167.

[4] Migne, *Patrologiæ Cursus*, series Græca, lxxxviii. (1860) 443. 446.

that it is a climbing plant, sticking close to high trees like a vine. native country he calls *Male*.[1] The Arabian authors of the middle a as Ibn Khurdádbah (*circa* A.D. 869–885), Edrisi in the middle of 12th, and Ibn Batuta in the 14th century, furnished nearly sin accounts.

Among Europeans who described the pepper plant with some ex ness, one of the first was Benjamin of Tudela, who visited the Mal Coast in A.D. 1166. Another was the Catalan friar, Jordanus,[2] a 1330; he described the plant as something like ivy, climbing trees forming fruit, like that of the wild vine. "This fruit," he says, "i first green, then when it comes to maturity, black." Nearly the s statements are repeated by Nicolo Conti, a Venetian, who at the be ning of the 15th century, spent twenty-five years in the East. observed the plant in Sumatra, and also described it as resembling iv

In Europe, pepper during the middle ages was the most estee and important of all spices, and the very symbol of the spice trad which Genoa, Venice and the commercial cities of Central Europe indebted for a large part of their wealth; and its importance as a m of promoting commercial activity during the middle ages, and the ci zing intercourse of nation with nation, can scarcely be overrated.

Tribute was levied in pepper,[4] and donations were made of spice, which was often used as a medium of exchange when money scarce. During the siege of Rome by Alaric, king of the Goths, 408, the ransom demanded from the city, included among other th 5000 pounds of gold, 30,000 pounds of silver, and 3000 pound *pepper*.[5] Facts of this nature, of which a great number migh enumerated, sufficiently illustrate the part played by this spic mediæval times.

The general prevalence during the middle ages of *pepper-rents*, w consisted in an obligation imposed upon a tenant to supply his with a certain quantity of pepper, generally a pound, at stated ti shows how acceptable was this favourite condiment, and how grea desire of the wealthier classes to secure a supply of it when the ma was not always certain.[6]

The earliest reference to a trade in pepper in England that we met with, is in the Statutes of Ethelred, A.D. 978–1016,[7] where enacted that the Easterlings coming with their ships to Billing should pay at Christmas and Easter for the privilege of trading London, a small tribute of cloth, five pairs of gloves, *ten pound pepper*, and two barrels of vinegar.[8]

The merchants who trafficked in spices were called *Piperarii*.

[1] *Bar* (as in Mala*bar*) merely signifies in Arabic, *coast*.

[2] *Mirabilia descripta* by Friar Jordanus, translated by Col. Yule. London, Hakluyt Society, 1863. 27.

[3] "Piperis arbor persimilis est ederæ, grana ejus viridia ad formam grani juniperi, quæ modico cinere aspersa torrentur ad solem."—Kunstmann, *Kenntniss Indiens im xv. Jahrhundert*, München (1863) 40.

[4] For some examples of this, see *Histoire de la vie privée des Français*, par Le Grand d'Aussy, nouvelle éd., ii. (1815) 182.

[5] Zosimus, *Historia* (Lips. 1784) l. 41.

[6] Rogers, *Agriculture and Prices in land*, i. (1866) 626. The term *pepper rent*, which has survived to our times, only signifies a nominal payment.

[7] *Ancient Laws and Institutes of Eng* published by the Record Commission (1840) 301.

[8] A striking contrast to the announce in a commercial paper, 27 Feb. 1874, the stock of pepper in the public warehou of London the previous week was 6035 t

ish *Pepperers*, in French *Poivriers* or *Pebriers*. As a fraternity or , they are mentioned as existing in London in the reign of Henry A.D. 1154–1189). They were subsequently incorporated as the ers' Company, and had the oversight and control of the trade in s, drugs, dye-stuffs, and even metals.[1]

he price of pepper during the middle ages was always exorbitantly for the rulers of Egypt extorted a large revenue from all those who engaged in the trade in it and other spices.[2] Thus in England een A.D. 1263 and 1399, it averaged 1*s.* per ℔., equivalent to about f our present money. It was however, about 2*s.* per ℔. (= 16*s.*) een 1350 and 1360.[3] In 1370, we find pepper in France valued s 6 deniers per ℔. (= fr. 21. c. 30):—in 1542 at a price equal to per ℔.[4]

he high cost of this important condiment contributed to incite the guese to seek for a sea-passage to India. It was some time after iscovery of this passage (A.D. 1498) that the price of pepper first ienced a considerable fall; while about the same period, the ation of the plant was extended to the western islands of the y Archipelago. The trade in pepper continued to be a monopoly of rown of Portugal as late as the 18th century.

ie Venetians used every effort to retain the valued traffic in their ıands, but in vain; and it was a fact of general interest when on 1st of January 1522, a Portuguese ship brought for the first time ›ices of India direct to the city of Antwerp. Strange to say, they received with great mistrust!

epper was heavily taxed in England. In 1623, the imposts levied amounted to 5*s.* per ℔.; and even down to 1823, it was subject to y of 2*s.* 6*d.* per ℔.

roduction—In the south-west of India, the plant, or *Pepper* as it is called, grows on the sides of the narrow valleys where ›il is rich and moist, producing lofty trees by which a constant, rable coolness, is maintained. In such places, the pepper-vine runs the ground and propagates itself by striking out roots into the soil. ıatives tie up the end of the vines lying on the ground to the it tree, on the bark of which the stems put out roots so far as they been tied, the shoots above that hanging down. The plant is le of growing to a height of 20 or 30 feet, but for the sake of nience it is usually kept low, and is often trained on poles. In where no vines occur naturally, the plant is propagated by planting ıear the roots of the trees on which it is to climb.

ie pepper plants if grown on a rich soil, begin to bear even in the ear, and continue to increase in productiveness till about the fifth, they yield 8 to 10 ℔. of berries per plant, which is about the ge produce up to the age of 15 to 20 years; after this they begin line.

hen one or two berries at the base of the spike begin to turn red, hole spike is pinched off. Next day the berries are rubbed off with

rbert, *Hist. of the twelve great Livery ies of London*, Lond. 1834. 303, 310.
nand, *Nouveau Journal asiatique*, nillet, 22–51.

[3] Rogers, op. cit. i. 641.
[4] Leber, *Appréciation de la fortune privée au moyen-âge*, éd. 2, Paris 1847. 95. 305.

the hands and picked clean; then dried for three days on mats smooth hard ground, or in bamboo baskets near a gentle fire.

In Malabar, the pepper-vine flowers in May and June, and the become fit for gathering at the commencement of the following y

Description—The small, round, berry-like fruits grow son loosely to the number of 20 to 30, on a common pendulous frui They are at first green, then become red, and if allowed to ripen, y but they are gathered before complete maturity, and by drying state turn blackish grey or brown. If left until quite ripe, the some of their pungency and gradually fall off.

The berries after drying are spherical, about $\frac{1}{5}$ inch in dia wrinkled on the surface, indistinctly pointed below by the rem the very short pedicel, and crowned still more indistinctly by th 4-lobed stigma. The thin pericarp tightly encloses a single se embryo of which in consequence of premature gathering is undev and merely replaced by a cavity situated below the apex. Th itself contains within the thin red-brown testa, a shining albume and horny without, and mealy within. The pungent taste and p smell of pepper are familiar to all.

Microscopic Structure—The transverse section of a gr black pepper exhibits a soft yellowish epidermis, covering the pericarp. This is formed of a closely-packed, yellow layer of mostly radially-arranged, thick-walled cells, each containing in it cavity a mass of dark-brown resin. The middle layer of the p consists of soft, tangentially-extended parenchyme, containi abundance of extremely small starch granules and drops of oil shrinking of this loose middle layer is the chief cause of th wrinkles on the surface of the berry. The next inner layer pericarp exhibits towards its circumference, tangentially-arrange parenchyme, the cells of which possess either spiral striation or fibres, but towards the interior, loose parenchyme free from star containing very large oil-cells.

The testa is formed in the first place of a row of small yellow walled cells. Next to them follows the true testa, as a dens brown layer of lignified cells, the individual outlines of wh undistinguishable.

The albumen of the seed consists of angular, radially-ar large-celled parenchyme. Most of its cells are colourless and with starch; others contain a soft yellow amorphous mass. I slices are kept under glycerin for some time, these masses are transformed into needle-shaped crystals of piperin.

Chemical Composition—Pepper contains resin and essen to the former of which its sharp pungent taste is due. The essen has more of the smell than of the taste of pepper.[2] The drug from 1·6 to 2·2 per cent. of this volatile oil, which agrees with

[1] For a full account of the cultivation of pepper, see Buchanan, *Journey from Madras through Mysore, Canara and Malabar*, ii. (1807) 455–520; iii. 158.

[2] As noticed by Rheede in 1688—". . . oleum ex pipere destillatum levem piperis odorem spirans, saporis parum acris *Malab.* vii. 24.—The oil was bro tained about a century before this Porta of Naples (*Magiæ Nat. lib.* x 185).

rpentine in composition as well as in specific gravity and boiling point. e find it, in a column 50 mm. long, to deviate the ray of polarized light ·4 to the left.

The most interesting constituent of pepper, *Piperin*, which pepper elds to the extent of 2 to 3 per cent., agrees in composition with the rmula $C^{34}H^{38}N^2O^6$, and is therefore isomeric with morphine. Piperin s no action on litmus paper; it is not capable of combining directly ith an acid, yet unites with hydrochloric acid in the presence of mer-ric and other metallic chlorides, forming crystallizable compounds. It insoluble in water; when perfectly pure, its crystals are devoid of lour, taste and smell. Its alcoholic solution is without action on larized light. Piperin may be resolved, as found by Anderson in 50, into *Piperic Acid*, $C^{12}H^{10}O^4$, and *Piperidin*, $C^5H^{11}N$. The latter a liquid colourless alkaloid, boiling at 106 C., having the odour of pper and ammonia, and directly yielding crystallizable salts.

Besides these constituents, pepper also contains some fatty oil in the socarp. Of inorganic matter, it yields upon incineration about 5 r cent.

Commerce—The import of pepper into the United Kingdom during 72, was 27,576,710 lb. valued at £753,970. Of this quantity, the raits Settlements supplied 25,000,000 lb., and British India 256,000 lb. *ack Pepper* is imported into the colony of Singapore (the chief port the Straits Settlements) from Rhio, the Malayan Peninsula and nang:—*White Pepper* almost exclusively from Rhio.[1]

The exports of pepper from the United Kingdom in 1872, amounted 17,891,620 lb., the largest quantity being taken by Germany 201,574 lb.) Then follows Italy (2,288,647 lb.); and Russia, Holland l Spain, each of which took more than a million pounds.[2]

The varieties of pepper quoted in price-currents are *Malabar, Alleppe l Cochin, Penang, Singapore, Siam.*

Uses—Pepper is not of much importance as a medicine, and is rarely ver prescribed, except indirectly as an ingredient of some preparation.

Adulteration—Whole pepper is not, we believe, liable in Europe to ulteration;[3] but the case is widely different as regards the pulverized ce. Notwithstanding the enormous penalty of £100, to which the nufacturer, possessor, or seller of adulterated pepper is liable,[4] and the r cost of the article, ground pepper has hitherto been frequently histicated by the addition of the starches of cereals and potatoes, of o, mustard husks, linseed and capsicum. The admixture of these stances may for the most part be readily detected after some practice. the microscope.[5]

White Pepper.

This form of the spice is prepared from black pepper by removing dark outer layer of pericarp, and thereby depriving it of a portion its pungency.

Blue Book of the Straits Settlements for

Annual Statement of the Trade of the for 1872. 59. 125.

According to Moolleen Sheriff (*Suppl. to m. of India*, 134) the berries of *Embelia Burm.* are said to be sometimes used for adulterating black pepper in the Indian bazaars.

[4] By the 59 George III. c. 53 § 22 (1819).

[5] Consult, Hassall, *Food and its Adulterations*, Lond. 1855. 42: Evans, *Pharm. Journ.* i. (1860) 605.

Buchanan, referring to Travancore, remarks that white pepp made by allowing the berries to ripen; the bunches are then gat and having been kept for three days in the house, are washed and b in a basket with the hand till all the stalks and pulp are removed.

The finest white pepper is obtained from Tellicherry, on the M Coast, but only in small quantity. The more important places f preparation are the Straits Settlements, whence 2 to 2½ millio pounds are annually exported. Most of the spice finds its way to (where it is highly esteemed. In Europe, pepper in its natural s with good reason preferred.

The grains of white pepper are of rather larger size than th black, and of a warm greyish tint. They are nearly spherical or s flattened. At the base, the skin of the fruit is thickened into a prominence, whence about 12 light stripes run meridian-like towar depressed summit. If the skin is scraped off, the dark-brown t seen enclosing the hard translucent albumen. In anatomical stru as well as in taste and smell, white pepper agrees with black, wh fact it represents in a rather more fully-grown state.

FRUCTUS PIPERIS LONGI.

Piper longum; Long Pepper; F. *Poivre long;* G. *Langer Pfeff*

Botanical Origin—*Piper officinarum* C. DC. (*Chavica*[1] *offici* Miq.), a diœcious shrubby plant, with ovate-oblong acuminate l attenuated at the base, and having pinnate nerves. It is a native Indian Archipelago, as Java, Sumatra, Celebes and Timor. Long p is the fruit-spike, collected and dried shortly before it reaches ma

Piper longum L. (*Chavica Roxburghii* Miq.), a shrub indigen Malabar, Ceylon, Eastern Bengal, Timor and the Philippines, also long pepper, for the sake of which it is cultivated along the east western coasts of India. It may be distinguished from the p species, by its 5-nerved leaves, cordate at the base.[2]

History—A drug termed Πέπερι μακρὸν, *Piper longum*, was to the ancient Greeks and Romans, and may have been the same *Long Pepper* of modern times.

In the Latin verses bearing the name of Macer Floridus,[3] whi probably written in the 10th century, mention is made of Black, and Long Pepper. The last-named spice, or *Macropiper*, is na Simon of Genoa,[4] who was physician to Pope Nicolas IV. and c to Boniface VIII. (A.D. 1288–1303), and travelled in the East for th of plants. Saladinus[5] in the middle of the 15th century enumerat pepper among the drugs necessary to be kept by apothecaries, and had a place in the pharmacopœias to the present time.

Production—In Bengal, the plants are cultivated by sucke require to be grown on a rich, high and dry soil; they should

[1] The genus *Chavica* separated from *Piper* by Miquel, has been re-united to it by Casimir de Candolle (*Prod.* xvi. s. 1). The latter genus is now composed of not fewer than 620 species!

[2] For good figures of the two p Hayne's *Arzney-Gewächse*, xiv. tab

[3] Choulant, *Macer Floridus de Herbarum*, Lipsiæ, 1832. 114.

[4] *Clavis Sanationis*, Venet. 1510.

[5] See p. 388, note 8.

ut five feet asunder. An English acre will yield in the first year ut three maunds (1 maund = 80 ℔.) of the pepper, in the second lve, and in the third eighteen; after which as the plant becomes and less productive, the roots are grubbed up, dried, and sold as *di-múl*, of which there is a large consumption in India as a medicine. pepper is gathered in the month of January, when full grown, and osed to the sun until perfectly dry. After the fruit has been col-ed, the stem and branches die down to the ground.[1]

Description—Long pepper consists of a multitude of minute baccate its, closely packed around a common axis, the whole forming a spike 1¼ inch long and ¼ of an inch thick. This spike is supported on alk ½ an inch long; it is rounded above and below, and tapers slightly ards its upper end. The fruits are ovoid, $\frac{1}{16}$ of an inch long, crowned h a nipple-like point (the remains of the stigma), and arranged rally with a small peltate bract beneath each. A transverse section spike exhibits 8 to 10 separate fruits, disposed radially with their rower ends pointed towards the axis. Beneath the pericarp, the thin wn testa encloses a colourless albumen, of which the obtuser end is upied by the small embryo.

The long pepper of the shops is greyish-white, and appears as if it been rolled in some earthy powder. When washed, the spikes uire their proper colour,—a deep reddish-brown. The drug has a ning aromatic taste, and an agreeable but not powerful odour.

The foregoing description applies to the long pepper of English mmerce, which is now obtained chiefly from Java (see next page), ere *P. officinarum* is the common species. In fact the fruits of this er, as presented to us by Mr. Binnendyk, of the Botanical Garden, itenzorg, near Batavia, offer no characters by which we can distin-sh them from the article found in the London shops. Those of *Betle* L. var. γ. *densum* are extremely similar, but we do not know t they are collected for use.

Microscopic Structure—The structure of the individual fruits mbles that of black pepper, exhibiting however some characteristic erences. The epicarp has on the outside, tangentially-extended, k-walled, narrow cells, containing gum; the middle layer consists of er, thin-walled, obviously porous parenchyme containing starch and ps of oil. In the outer and middle layers of the fruit, numerous e thick-walled cells are scattered, as in the external pericarp of *Piper rum*; in long pepper however, they do not form a closed circle. The er pericarp is formed of a row of large, cubic or elongated, radially-nged cells, filled with volatile oil. A row of smaller tangentially-nded cells separates these oil-cells from the compact brown-red testa, ich consists of lignified cells like the inner layer of the testa of black per, but without the thick-walled cells peculiar to the latter. The amen of long pepper is distinguished from that of black pepper by the ence of volatile oil.

Chemical Constituents—The constituents of long pepper appear be the same as those of black pepper. We are not aware of any nt analysis, or whether the proportions of piperin and of volatile oil

[1] Roxburgh, *Flora Indica*, i. (1832) 155.

The resin and ... reside exclusive

—Long pepper is at present exported from Sing... it it ... chiefly from Java, and to a much smaller ... ntity exported from Singapore in 1871, amo... 5 cwt., ... only 447 cwt. were shipped to the United King... ng ... t chiefly to British India.[1] There is a ... port of ... g pepper from Calcutta.

—Long ... r ... used as a medicine, black p... in ... few ... eparations in which it was for... it ... loyed as a ... ce and in veterinary medicine. ... ro of ... m, called in Sanskrit *Pippali* ... *úl*), is a favourite remedy ... and a ... to the Per... ns and Arabs.

CUBEBÆ.

Fructus vel Baccæ vel Piper Cubebæ[2]; *Cubebs*; F. *Cubèbes*; G. *Cu*...

Botanical Origin—*Piper* ... *ba* Linn. f. (*Cubeba officinalis* ... a climbing, woody, diœcious shrub, indigenous to Java, Southern B... and Sumatra.

History—Cubebs appear to ... e been introduced into medici... the Arabian physicians of the ... ages, who describe them as ... the form, colour, and properties of pepper. Masudi[3] in the ... century stated them to be a production of Java. Edrisi[4] the geogr... in A.D. 1153, enumerated them among the imports of Aden.

Among European writers, Constantinus Africanus of Salern... acquainted with this drug as early as the 11th century; and i... beginning of the 13th, its virtues were noticed in the writings ... Abbess Hildegard in Germany, and even in those of Henrik Harpe... in Denmark.[5]

Cubebs are mentioned as a production of Java ("*grant isle de Ja*... by Marco Polo; and by Odoric, an Italian friar, who visited the ... about forty years later. In the 13th century, the drug was an ... of European trade. Duty was levied upon them as *Cubebas silves*... Barcelona in 1271.[6] They are mentioned about this period as s... the fairs of Champagne in France, the price being 4 *sous* per ℔.[7] ... were also sold in England: in accounts under date 1284, th... enumerated with almonds, saffron, raisins, white pepper, grai... paradise], mace, galangal and gingerbread, and entered as costi... per ℔. In 1285—2*s.* 6*d.* to 3*s.* per ℔.; while in 1307, 1 ℔. pur... for the King's Wardrobe cost 9*s.*[8]

From the journal of expenses of John, king of France, wh... England during 1359–60, it is evident that cubebs were in fr...

[1] *Blue Book of the Straits Settlements* for 1871.

[2] *Cubeba* from the Arabic *Kabábah*.

[3] *Les Prairies d'or*, i. 341.

[4] *Géographie*, trad. par Jaubert, i. 51. 89.

[5] Meyer, *Geschichte der Botanik*, iii. 537.

[6] Capmany, *Memorias sobre la Marina, etc. de Barcelona*, i. 44.

[7] Bourquelot, *Etudes sur les f... Champagne, Mémoires etc. de l'Ins...* (1865) 288.

[8] Rogers, *Hist. of Agriculture an... in England*, i. 627–8, ii. 544.—To g... idea of the relative value of com... then and now, multiply the ancien... by 8.

spice. Among those who could command such luxuries, they en in powder with meat, or they were candied whole. A pontage granted in 1305 by Edward I., to aid in repairing and the Bridge of London, and authorizing toll on various articles, among groceries and spices, *cubebs* as liable to impost.[1] Cubebs ioned in the *Confectbuch* of Hans Folcz of Nuremberg, dating 30.[2]

not however be said that cubebs were a common spice, at all le with pepper or ginger, or even in such frequent use as grains se or galangal. Garcia d'Orta (1563) speaks of them as but sed in Europe; yet they are named by Saladinus as necessary pt in every *apotheca*.[3] In a list of drugs to be sold in the ies' shops of the city of Ulm, A.D. 1596, cubebs are mentioned *s carpesiorum vel cubebarum*, the price for half an ounce being 8 *kreuzers*, the same as that of opium, best manna, and amber, ck and white pepper are priced at 2 *kreuzers*.[4]

pecific action of cubebs on the urino-genital organs has been ly in very recent times. Writers on materia medica even at encement of the present century, mention the drug simply as ie stimulant resembling pepper, but inferior to that spice and ployed,[5]—in fact it had so far fallen into disuse that it was om the London Pharmacopœia of 1809. According to Crawfurd, ation into Europe, which had long been discontinued, recom- n 1815, in consequence of its medicinal virtues having been o the knowledge of the English medical officers serving in Java, Hindu servants.[6]

vation and Production[7]—Cubebs are cultivated in small lantations and also in coffee plantations, in the district of s in the south of Java. The fruits are bought by Chinese who m to Batavia. They are likewise produced in Eastern Java . Bantam in the north-west; and extensively in the Lampong n Sumatra. There has of late been a large distribution of ong the European coffee planters.

ultivation of cubebs is easy. In the coffee estates certain trees red for shade: against these, *Piper Cubeba* is planted, and to a height of 18 to 20 feet, forms a large bush.

ription—The cubebs of commerce consist of the dry glo- s, gathered when full grown, but before they have arrived at The fruit is about ⅛ of an inch in diameter, when very young it subsequently elevated on a straight thin stalk, a little longer

iger Scaccarii, Lond. 1771, i. anslation may be found in the *London Bridge*, 1827. 155.

t, *Macer Floridus* etc., Lips.

lium aromatariorum, Bonon.,

l, *Beitrag zur Geschichte der* 1825. 124.

can's *Edinburgh New Dispensa-* 1804, *Piper Cubeba* is very ibed, but with no allusion to it ny special medicinal properties. dition of the same work (1811) it was altogether omitted. See also Murray's *System of Mat. Med. and Pharm.* i. (1810) 266.

[6] *Dictionary of the Indian Islands*, 1856. 117.—Mr. Crawfurd himself communicated to the *Edinburgh Medical and Surgical Journal* of 1818 (xiv. 32) a paper making known the "wonderful success" with which cubebs had been used in gonorrhœa.

[7] We are indebted for some particulars under this head to my friend Mr. Binnendyk, of the Buitenzorg Botanical Garden near Batavia.—D. H.

eutral substance, crystallizing in small needles or scales, of a re, nearly insoluble in cold but slightly soluble in hot water. s freely in boiling alcohol, but is mostly deposited upon t requires 30 parts of cold ether for solution. Bernatzik om cubebs 0·40 per cent. of cubebin,[1] Schmidt 2·5 per cent.[2] ls which are deposited in an alcoholic or ethereal extract of nsist of cubebin in an impure state. Cubebin is devoid of kable therapeutic action; its composition answers to the $^{3}H^{34}O^{10}$.

in extracted from cubebs consists of an indifferent portion, r cent., and of *Cubebic Acid*, amounting to about 1 per cent. . Both are amorphous, and so according to Schmidt, are the bebic acid. Bernatzik however, found some of them, as that to be crystallizable. Schulze (1873) prepared cubebic acid rystallized sodium-salt, but was unable to get it other than . The resins, the indifferent as well as the acid, possess the properties of the drug.

t further pointed out the presence in cubebs, of gum (8 per oil, and malates of magnesium and calcium.

erce—Cubebs were imported into Singapore in 1872 to the 3062 cwt., of which amount 2348 cwt. were entered as from ls India. The drug was re-shipped during the same year to t of 2766 cwt., the quantity exported to the United Kingdom) cwt., to the United States of America 1244 cwt., and to dia 104 cwt.[3] In the previous year, a larger quantity was India than to Great Britain.

-Cubebs are much employed in the treatment of gonorrhœa. is usually administered in powder; less frequently in the hereal or alcoholic extract, or essential oil.

zik and Schmidt, whose chemical and therapeutical experi- e thrown much light on the subject, have shown that the cubebs being dependent on the indifferent resin and cubebic rations which contain the utmost amount of these bodies and her constituents of the drug, are to be preferred. They would essential oil, as they find its administration devoid of thera- cts.

eparations which consequently are to be recommended, are the prived of their essential oil and constituents soluble in water, dried and powdered; an alcoholic extract prepared from the e purified resins.

eration—Cubebs are not much subject to adulteration, though means rare that the imported drug contains an undue pro- the inert stalks (rachis)[4] that require to be picked out before s are ground. Dealers judge of cubebs by the oiliness and racteristic smell of the berries when crushed. Those which

[1] in *Canstatt's Jahresbericht schritte in der Pharmacie*, xiv. and Husemann, *Jahresbericht*,

[3] *Straits Settlements Blue Book for* 1872. 294. 338.—There are no statistics for showing the *total import* of cubebs into the United Kingdom.

[4] They yielded to Schmidt 1·7 per cent. of oil and 3 per cent. of resin.

HERBA MATICO.

Matico.

nical Origin—*Piper angustifolium* Ruiz et Pavon (*Artanthe* Miq.) a shrub growing in the moist woods of Bolivia, Peru, ew Granada and Venezuela, also cultivated in some localities. ly different, somewhat stouter form of the plant with leaves ches long (var. *a. cordulatum* Cas. DC.), occurs in the Brazilian s of Bahia, Minas Geraes and Ceará, as well as in Peru and the parts of South America.

ory—The styptic properties of this plant are said to have been ed by a Spanish soldier named Matico,[1] who having applied the leaves to his wounds, observed that the bleeding was thereby ; hence the plant came to be called *Yerba* or *Palo del Soldado* herb or tree). The story is not very probable, but it is current parts of South America, and its allusion is not confined to the der notice.

æmostatic powers of matico, which are not noticed in the works and Pavon, were first recognized in Europe by Jeffreys,[2] a physi- Liverpool, in 1839, but they had already attracted attention in merica as early as 1827.

cription—Matico, as it arrives in commerce, consists of a com- coherent, brittle mass of leaves and stems, of a light green hue sant herby odour. More closely examined, it is seen to be made inted stems bearing lanceolate, acuminate leaves, cordate and at the base, and having very short stalks. The leaves are rather ith their whole upper surface traversed by a system of minute ns, which divide it into squares and give it a tessellated appear- On the under side, these squares form a corresponding series of ons which are clothed with shaggy hairs. The leaves attain a f about 6 inches by 1½ inches broad. The flower and fruit spikes e often 4 to 5 inches long, are slender and cylindrical with the r fruits densely packed. The leaves of matico have a bitterish taste.

nical Composition—The leaves yield a small amount of oil, which we find slightly[3] dextrogyre; a large proportion of s at 180° to 200° C., the remainder becoming thickish. Both are lighter than water; but another specimen of the oil of which we had kept for some years, sinks in water. We have that in winter the oil deposits remarkable crystals of a cam- re than half an inch in length, fusible at 103° C.

co further affords, according to Marcotte (1864),[4] a crystallizable ned *Artanthic Acid*, besides some tannin. The latter is made by the dark brown colour which the infusion assumes on addition chloride. The leaves likewise contain resin, but as shown by 1858, neither piperin, cubebin, nor any analogous principle such -called *Maticin* formerly supposed to exist in them.

is the diminutive of *Mateo*, the *Matthew*.

on the efficacy of Matico as a astringent, 3rd ed., Lond. 1845.

[3] Deviating only 0·7° in a column 50 mm. long.

[4] Guibourt (et Planchon), *Hist. des Drogues*, ii. (1869) 278.

weed that was brought from Virginia and grew with Mr. John cant at South Lambeth, anno 1632." It was very briefly noticed nuti in his *Canadensium Plantarum Historia* (1635), and in a more intelligent manner by Parkinson in 1640. These authors, l as Dale (1693) and Geoffroy (1741), extol the virtues of the s a remedy for the bite of the rattlesnake, or of a rabid dog. tary was introduced into the London Pharmacopœia in 1650.

scription—The snake-root of commerce includes the rhizome, is knotty, contorted, scarcely 1 inch in length by ⅛ of an inch in ess, bearing on its upper side the short bases of the stems of ıs years, and throwing off from the under, numerous, slender, , branching roots, 2 to 4 inches long. The rhizome is often still d to portions of the weak, herbaceous stem, which sometimes the fruit,—more rarely flowers and leaves. The drug has a dull hue, an aromatic odour resembling valerian but less unpleasant, bitterish aromatic taste, calling to mind camphor, valerian and tine.

croscopic Structure—In the rhizome, the outer layer of the onsists of a single row of cuboid cells; the middle cortical portion *ilæum*) of about six layers of larger cells. In the liber, which is ıp of numerous layers of smaller cells, those belonging to the ary rays are nearly cuboid with distinctly porous walls, those of er bundles being smaller and arranged in a somewhat crescent- manner. Groups of short, reticulated or punctuated vessels te in the woody rays with long, porous, ligneous cells, those close pith having thick walls. The largest cells of all are those composing h; the latter, seen in transverse section, occupies not the very of the rootstock, but is found nearer to its upper side. The exhibit a central fibro-vascular bundle, surrounded by a nucleus In the mesophlœum both of the rootstock and the rootlets, ccur a few cells containing a yellow essential oil. The other cells led with starch.

emical Composition—Essential oil exists in the drug to the of about ½ per cent.; and resin in nearly the same proportion. ter cortical layer, as well as the zone of the nucleus-sheath, con- little tannin, and a watery infusion of the drug is coloured greenish chloride of iron. Neutral acetate of lead precipitates some muci- well as the bitter principle (the so-called *Aristolochin* of Chevallier?) latter may also be obtained by means of tannic acid. It is an ous, bitter substance, which deserves further investigation. By line solution of tartrate of copper the presence in serpentary r is made evident.

nmerce—Virginian snake-root is imported from New York and in bales, casks or bags.

es—The drug is employed in the form of an infusion or tincture imulating tonic and diaphoretic; it is more often prescribed in ation with cinchona bark than by itself. Its ancient reputation cure of snake-bites is now disregarded.

dulteration and Substitution—Virginian snake-root is said to ıetimes adulterated with the root of *Spigelia Marilandica* L.,

which has neither its smell nor taste (see p. 389); or with that of *Cypripedium pubescens* L., which it scarcely at all resembles. It is not uncommon to find here and there in the serpentary of commerce, a root of *Panax quinquefolium* L. accidentally collected, but never added for the purpose of adulteration.

The root of *Aristolochia reticulata* Nutt., a plant of Louisiana and Arkansas, has been brought into commerce in considerable quantity as *Texan* or *Red River Snake-root.*[1] We are indebted for an authentic specimen from the Cherokee country, to Mr. Merrell, a large dealer in herbs at St. Louis, Missouri, who states that all the serpentary grown south-west of the Rocky Mountains is the produce of that species. The late Prof. Parrish of Philadelphia was kind enough to supply us with specimens of the same drug, as well as with reliable samples of the *Virginian* or *Middle States Snake-root.*

The Texan snake-root is somewhat thicker and less matted than that derived from *A. Serpentaria,* but has the odour and taste of the latter; some say it is less aromatic. The plant, portions of which are often present, may be easily distinguished by its leaves being *coriaceous, sessile* and *strongly reticulated* on their under surface.

CUPULIFERÆ.

CORTEX QUERCUS.

Oak Bark; F. *Ecorce de Chêne;* G. *Eichenrinde.*

Botanical Origin—*Quercus Robur* L., a tree, native of almost the whole of Europe, from Portugal and the Greek Peninsula as far north as 58° N. lat. in Scotland, 62° in Norway, and 56° in the Ural Mountains.

There are two remarkable forms of this tree which are regarded by many botanists as distinct species, but which are classed by De Candolle as sub-species.

Sub-species I. *Pedunculata*—with leaves sessile or shortly stalked and acorns borne on a long peduncle.

Sub-species II. *Sessiliflora*—with leafstalks more or less elongated and acorns either sessile or growing on a short peduncle.

Both forms occur in Britain. The first is the common oak of the greater part of England and the lowlands of Scotland. The second frequently scattered in woods in which the first variety prevails, but rarely constitutes the mass of the oak woods in the south of England. In North Wales however, in the hilly parts of the north of England and in Scotland, it is the commoner of the two forms (Bentham).

History—The astringent properties of all parts of the oak[3] were well known to Dioscorides, who recommends a decoction of the inner bark in colic, dysentery and spitting of blood. Yet oak bark seems for no time to have been held in great esteem as a medicine, probably

[1] Wiegand in *American Journ. of Pharm.* x. (1845) 10—also *Proceedings of the American Pharmaceutical Association,* xxi. (1873) 141.

[2] *Prodromus,* xvi. (1864) sect. 2 fo

[3] Probably not *Q. Robur* L.

count of its commonness; and it is now almost superseded by other tringents. For tanning leather, it has always been largely employed.

Description—For medicinal use, the bark of the younger stems or anches is collected in the early spring. It varies somewhat in appearice according to the age of the wood from which it has been taken: at usually supplied to English druggists is in channelled pieces of riable length and a tenth of an inch or less in thickness, smooth, of a ining silvery grey variegated with brown, dotted over with little scars. e inner surface is light rusty-brown, longitudinally striated. The icture is tough and fibrous. A transverse section shows a thin, greenish rk-layer, within which is the brown parenchyme, marked with numerous ws of translucent colourless spots. The smell of dry oak bark is very int; but when the bark is moistened, the odour of tan becomes evident. e taste is astringent and in old barks, slightly bitter.

Microscopic Structure—The outer layer of young oak bark consts of small flat cork-cells; the middle layer of larger thick-walled lls, slightly extended in a tangential direction and containing brown ains and chlorophyll. This tissue passes gradually into the softer rrower parenchyme of the inner bark, which is irregularly traversed narrow medullary rays. It exhibits moreover a ring, but slightly terrupted, of thick-walled cells (sclerenchyme) and isolated shining ndles of liber fibres.

Groups of crystals of calcium oxalate are frequent in the middle and ner bark, but the chief constituents of the cells are brown granules of louring matter and tannin. As the thickness of the bark increases, e liber is pushed more to the outside, the middle cortical layer being rtly thrown off by secondary cork-formation (rhytidoma, see p. 317). ence the younger barks, which alone are medicinal, are widely different m the older in structure and appearance.

Chemical Composition—The most interesting constituent is a culiar kind of tannin. Stenhouse pointed out in 1843, that the nic acid of oak bark is not identical with that of nutgalls; and such ny years afterwards was proved to be the case.

The first-named substance, now called *Querci-tannic Acid*, yields by structive distillation, pyrocatechin but not pyrogallol. It does not ord by oxidation, gallic acid. A solution of gelatine is precipitated querci-tannic acid as well as by gallo-tannic acid; yet the compound rmed with the latter is very liable to putrefaction, whereas the tannin oak bark, which is accompanied by a large amount of extractive atter, furnishes a stable compound, and is capable of forming good ather.

As querci-tannic acid has not yet been isolated in a pure state, the act estimation of the strength of the tanning principle in oak bark has t been accomplished, although it is important from an economic as well from a scientific point of view. The best method is that of Neubauer 873), which depends upon the amount of permanganate of potassium composable by the extract of a given weight of oak bark. Neubauer and in the bark of young stems, as grown for tanning purposes, from to 10 per cent. of querci-tannic acid, soluble in cold water.

A colourless, crystallizable, bitter, neutral substance, soluble in water t not in absolute alcohol or ether, was extracted from oak bark in

1843 by Gerber, and named *Quercin*. It requires further examinat C. Eckert[1] could not detect its existence in young oak bark.

Uses—Occasionally employed as an astringent, chiefly for ext application.

GALLÆ HALEPENSES.

Gallæ Turcicæ; Galls, Nutgalls, Oak Galls, Aleppo or Turkey G F. *Noix de Galle, Galle d'Alep;* G. *Levantische oder Alep Gallen, Galläpfel.*

Botanical Origin—*Quercus Lusitanica* Webb, var. *infectori infectoria* Oliv.),[2] a shrub or rarely a tree, found in Greece, Asia M Cyprus and Syria. It is probable that other varieties of this o well as allied species, contribute to furnish the Aleppo galls of comm

History—Oak galls are named by Theophrastus who lived i 3rd or 4th century B.C., and were well known to other ancient w Pliny[3] mentions the interesting fact that paper saturated wit infusion of galls may be used as a test for discovering sulphate of when added as an adulteration to the more costly verdigris: according to Kopp, is the earliest instance of the scientific applicatio chemical reaction.[4] For tanning and dyeing, galls have been used the earliest times.

Nutgalls have long been an object of commerce between W Asia and China. Barbosa in his *Description of the East Indies*[5] w in 1514, calls them *Magican*[6] and says they are brought from the L to Cambay by way of Mekka, and that they are worth a great d China and Java. From the statements of Porter Smith,[7] we lear they are still prized by the Chinese.

Formation—Many plants are punctured by insects for the s depositing their eggs, which operation gives rise to those excres which bear the general name of *gall*.[8]

Oaks are specially liable to be visited for this purpose by ins the order *Hymenoptera* and the genus *Cynips*, one species of *Cynips Gallæ tinctoriæ* Olivier (*Diplolepis Gallæ tinctoriæ* La occasions the galls under notice.

The female of this little creature is furnished with a delicate l ovipositor, which she is able to protrude from the extremity abdomen: by means of it, she pierces the tender shoot of the oa deposits therein one or more eggs. This minute operation occasi abnormal affluence to the spot, of the juices of the plant, the re which is the growth of an excrescence often of great magnitude, centre of which (but not as it appears until the gall has becom grown) the larva is hatched and undergoes its transformations.

[1] Wittstein, *Vierteljahresschr. für prakt. Pharm.* xiii. (1864) 494.

[2] De Candolle, *Prodromus*, xvi. sect. 2. fasc. i. 17.

[3] Lib. 34. c. 26.

[4] *Geschichte der Chemie*, ii. (1844) 51.

[5] Published by the Hakluyt Society, Lond. 1866. 191.

[6] Nearly the same name is still used in the Tamil, Telugu, Malayalim and languages.

[7] *Mat. Med. and Nat. Hist.* 1871. 100.

[8] French writers, as Moquin-Ta tinguish the thick-walled galls from the thin, capsular galls fo *Aphis*, terming the former *galls* latter *coques* (shells).

When the larva has assumed its final developement and become a ged insect, which requires a period of five to six months, the latter es itself a cylindrical passage from the centre of the gall to its 'ace, and escapes.

In the best kind of gall found in commerce, this stage has not yet ved, the gall having been gathered while the insect is still in the 'al state. In splitting a number of galls, it is not difficult to find cimens in all stages, from those containing the scarcely distinguishable ains of the minute larva, to those which show the perfect insect to e perished when in the very act of escaping from its prison.

Description—Aleppo galls[1] are spherical, and have a diameter $\frac{1}{16}$ to $\frac{1}{8}$ of an inch. They have a smooth and rather shining surface, rked in the upper half of the gall by small pointed knobs and ridges, anged very irregularly and wide apart; the lower half is more quently smooth. The aperture by which the insect escapes is always r the middle. When not perforated, the galls are of a dark olive en, and comparatively heavy; but after the fly has bored its way out, y become of a yellowish brown hue, and lighter in weight. Hence distinction in commerce of *Blue* or *Green Galls*, and *White Galls*.

Aleppo galls are hard and brittle, splitting under the hammer; they e an acidulous, very astringent taste followed by a slight sweetness, t have no marked odour. Their fractured surface is sometimes close-ined, with a waxy or resinous lustre; sometimes (especially towards kernel-like centre) loosely granular, or sometimes again it exhibits a stalline-looking radiated structure or is full of clefts. The colour of interior varies from pale brown to a deep greenish yellow. The ntral cavity, sometimes nearly $\frac{1}{4}$ of an inch in diameter, which served a dwelling for the insect, is lined with a thin hard shell. If the ect has perished while still very young, the central cavity and the erture contain a mass of loose starchy cellular tissue, or its pulverulent ains: if the insect has not been developed at all, the centre of the l is entirely composed of this tissue.

Microscopic Structure—The cellular tissue of the gall is formed the middle layer of large spherical cells with rather thick porous lls, becoming considerably smaller towards the circumference. The ermost rows are built up of cells having but a very small lumen and nparatively thick walls, so that they form a sort of rind. Here and re throughout the entire tissue, there occur isolated bundles of vessels ich pass through the stalk into the gall. Towards the kernel, the enchyme gradually passes into radially-extended, wider, thin-walled ls, the walls of which are marked with spiral striæ. The hard ll of the chamber[2] is composed of larger, radially-extended, thick-lled cells, with beautifully stratified porous walls. On the inner side this shell there are found after the escape of the insect, the remains the starchy tissue already mentioned, which originally filled the mber and had been consumed by the insect as nourishment.

There are many other varieties of oak , for descriptions of some of which, see bourt, *Hist. des Drogues*, ii. (1869) 292; for information on the various gall-sts of the family *Cynipsidæ* and the ex-sences they produce, consult a paper by Abl in Wittstein's *Vierteljahrsschrift für prakt. Pharm.* vi. (1857) 343–361.

[2] *Couche protectrice* of Lacaze Duthiers—*Recherches pour servir à l'histoire des galles.*—*Ann. des Sciences Nat.*, Bot., xix. (1853) 273–354.

ed from the market. Pereira directed attention to them which time they have formed a regular and abundant rt both from China and Japan. At present the supplies om Hankow, from which great trading city, the export no less than 30,949 peculs, equal to 36,844 cwt.[1] The ted from China into the United Kingdom in 1872, was ed at £20,098.

ls are vesicular protuberances formed on the leafstalks the above-mentioned tree, by the puncture of an insect, igured by Doubleday[2] as a species of *Aphis*, and subse- provisionally by Jacob Bell,[3] *A. Chinensis*. We have any competent observer of their growth and collection; development, we can only imagine it from the analogous n in Europe. According to Doubleday, it is probable aphis punctures the upper surface of a leaf (more pro- , the result of the wound being the growth of a hollow he vegetable tissue. Of this cavity the creature takes brings forth a progeny which lives by puncturing the f their home, thus much increasing the tendency to a ion of the soft growing tissue in an outward direction. neck of the sac-like gall thickens, the aperture contracts ses, imprisoning all the inmates. Here they live and as in the case of the pistacia gall of Europe, the sac lows of their escape. This, we may imagine, takes place hen, after some generations all wingless and perhaps all female aphis produces for several generations without a winged generation is brought forth of both sexes. These other spots, and deposit eggs for a further propagation

e light and hollow, varying in length from 1 to 2½ inches, ly diverse and irregular form. The simplest are some- d, the smaller end being attached to the leafstalk; but ely so regular, and more often the body of the gall is merous knobby or horn-like protuberances or branches; sists of several lobes uniting in their lower part and gra- d to the point by which the excrescence is attached to though the form is thus variable, the structure of these characteristic. They are striated towards the base, and red on other parts with a thick, velvety, grey down, which he prominences, displays the reddish brown colour of the he latter is $\frac{1}{16}$ to $\frac{1}{20}$ of an inch in thickness, translucent brittle with a smooth and shining fracture. It is rather e inner surface and of lighter colour than on the outer. hen broken are generally found to contain a white, downy- ice, together with the minute, dried-up bodies of the insect.

de at the Treaty Ports of 54.—In the China trade always miscalled "*Nut* ."

vii. (1848) 310.

128.

met with galls imported h differed from ordinary Chinese galls in not being horned, but all of an elongated ovoid form, often pointed at the upper end, and having moreover a strong *cheesy* smell. They may be derived from *Distylium racemosum* S. et Z., though they do not perfectly accord with the depressed pear-shaped forms figured by Siebold and Zuccarini (*Flora Japonica*, tab. 94).

us spicatus Br. (*Santalum spicatum* DC., *S. cygnorum* Miq.)[1] ıe sandal-wood tree is protected by Government and is the profitable commerce. In other countries it has been left to as usually been extirpated, at least from all accessible places, v years of its discovery.

y—Sandal wood, the Sanskrit name for which, *Chandana*, into many of the languages of India, is mentioned in the writings of Yaska, the oldest Vedic commentary extant, later than the 5th century B.C. The wood is also referred to ent Sanskrit epic poems, the *Ramayana* and *Mahabharata*, ich may be of nearly as early date.

:hor of the *Periplus of the Erythrean Sea*, written about the the 1st century, enumerates sandal wood (*Ξύλα σαγαλίνα*) indian commodities imported into Omana in the Persian Gulf.[2] *νδάνα* mentioned towards the middle of the 6th century by licopleustes[3] as brought to Taprobane (Ceylon) from China emporia, was probably the wood under consideration. In essential oil was used as early as the 9th century in embalm- ses of the princes.

wood is named by Masudi[4] as one of the costly aromatics of ı Archipelago. In India, it was used in the most sacred f which a memorable example still exists in the famous gates ı, supposed to be 1000 years old.[5]

European writers, Constantinus Africanus, who flourished at he 11th century, was one of the earliest to mention *Sandalum*.[6] i, called Serapion the Younger, who lived about the same s acquainted with *white*, *yellow*, and *red* sandal wood.[7] All s of sandal wood also occur in a list of drugs[8] in use at *circa* A.D. 1450; and in the *Compendium Aromatariorum* of published in 1488, we find mentioned as proper to be kept by apothecary,—"*Sandali trium generum, scilicet albi, rubii et*

er the *red* sandal here coupled with *white* and *yellow*, was the vood of *Pterocarpus santalinus*, now called *Lignum santalinum Red Sanders* (see p. 175), is extremely doubtful. It may t real sandal wood, of which three shades, designated *white*, *low*, are still recognized by the Indian traders.[9]

Santalum lanceolatum Br., a roughout N. and E. Australia *ndal wood* by the colonists, is rade, we know not.

Commerce and Navigation of ii. (1807) 378.

ıtrologiæ Cursus, series Græca,

ries d'Or, texte et traduction le Meynard et Pavet de Cour- l) 222.

11 feet high and 9 feet wide, rved out of sandal wood; they ted for the temple of Somnath ıce esteemed the holiest temple ı its destruction in A.D. 1025, e carried off to Ghuzni in Af- here they remain-d ı ıat city by the E when they were taken back to India. They are now preserved in the citadel of Agra. For a representation of the gates, see *Archæologia*, xxx. (1844) pl. 14.

[6] *Opera*, Basil. 1536 39, *Lib. de Gradibus*, 369.

[7] *Liber Serapionis aggregatus in medicinis simplicibus*, 1473.

[8] Fluckiger, *Die Frankfurter Liste*, Halle, 1873. 11.

[9] Thus Milburn in his *Oriental Commerce* (1813), says—". . . the deeper the colour, the higher is the perfume; and hence the merchants sometimes divide sandal into *red*, *yellow*, and *white*, but these are all different shades of the same colour and do not arise from any difference in the species of the '—(i. 291.)

weighed, subjected to a second and more careful trimming, and ssified according to quality. In some parts, it is customary not to but to dig the tree up; in others, the root is dug up after the trunk been cut down,—the root affording valuable wood, which with the ps and sawdust are preserved for distillation, or for burning in the ive temples. The sap wood and branches are worthless.[1]

In 1863, a sort of sandal wood afforded by *Fusanus spicatus* (p. 541), s one of the chief exports of Western Australia, whence it was pped to China. A trifling payment for permission to cut growing ber of any kind, was the only barrier placed on the felling of the es. The farmers employed their teams during the dull season in inging to Perth or Guildford the logs of sandal which had been felled d trimmed in the bush; and there was a flourishing trade so long as es of a fair size could be obtained within 100 or even 150 miles of towns, where the commodity was worth £6 to £6 10*s.* per ton. But ill-regulated and improvident destruction of the trees in the more ily accessible districts, has so reduced their numbers that the trade that part of Australia soon came to an end.[2] Australian sandal wood pears however to be still an article of commerce, if one may draw h an inference from the fact that 47,904 cwt. of sandal wood were ported into Singapore from Australia in the year 1872. It was mostly shipped to China.[3]

Description—Sandal wood is not much known in English commerce, l is by no means always to be found even in London. That which have examined and which we believe was Indian, was in cylindrical s mostly about 6 inches in diameter (the largest 8 inches—smallest nches) and 3 to 4 feet long, extremely ponderous; the bark had been oved. A transverse section of sandal wood exhibits it of a pale wn, marked with rather darker concentric zones and (when seen der a lens) numerous open pores. The tissue is traversed by medul- y rays, also perceptible by the aid of a lens. The wood splits easily, itting when comminuted an agreeable odour which is remarkably sistent; it has a strongish aromatic taste.

The varieties of sandal wood are not classified by the few persons o deal in the article in London, and we are unable to point out cha- ters by which they may be distinguished. In the price-currents of mercial houses in China, three sorts of sandal wood are enumerated, nely *South Sea Island, Timor* and *Malabar;* the last fetches three four times as high a price as either of the others. Even the Indian dal wood may vary in an important manner. Beddome,[4] conser- or of forests in Madras, and an excellent observer, remarks that the st sandal wood is that which has grown slowly on rocky, dry and poor d; and that the trees found in a rich alluvial soil, though of very fine wth, produce no heart-wood and are consequently valueless. A variety he tree with more lanceolate leaves (var. β. *myrtifolium* DC.), native

Elliot, *Experiences of a Planter in the les of Mysore*, ii. (1871) 237; also al information communicated by Capt. pbell Walker, Deputy Conservator of sta, Madras.

Millett, *An Australian Parsonage*, L, 1872, 43. 95. 382.

[3] *Straits Settlements Blue Book for* 1872, Singapore, 1873. 298. 347.—It is possible that the sandal wood in question may have been the produce of the South Sea Islands, shipped from an Australian port.

[4] Op. cit.

ırgely consumed in the celebration of sepulchral rites, wealthy ; showing their respect for a departed relative by adding sticks of wood to the funereal pile. The powder of the wood made into a ·ith water, is used for making the caste mark, and also for medicinal es. The consumption of sandal wood in China appears to be ally for the incense used in the temples.

CONIFERÆ.

TEREBINTHINA VULGARIS.

or Common Turpentine ; F. Térébenthine commune ; G. Gemeiner Terpenthin.

tanical Origin—The trees which yield Common Turpentine may idered in two groups, namely, European and American.

European—In Finland and Russia Proper, the Scotch Pine, *Pinus 's* L. ; in Austria and Corsica, *P. Laricio* Poiret ; and in South- ı France, *P. Pinaster* Solander (*P. maritima* Poiret), known as ı *maritime*, yield turpentine in their respective countries.

American—In the United States, the conifers most important for :hinous products, are the Swamp Pine, *Pinus australis* Michaux *ıstris* Mill.), and the Loblolly Pine, *P. Tæda* L.

ıtory—The resin of pines and firs was well known to the ancients, ıtained it in much the same manner as that practised at the day. The turpentine used in this country has for many years en derived from North America. Up to the last century, both it e substance called *Common Frankincense* were imported from The late civil war in the United States and the blockade of the n ports, occasioned a great scarcity of American turpentine ; and :hinous substances from all other countries were poured into the market. The actual supplies however, were mainly furnished ıce.

ɔp[1] quotes a passage showing that the essential oil of turpentine own to Marcus Græcus, who termed it *Aqua ardens*. This almost n personage is the reputed inventor of *Greek Fire*, a dreaded of destruction in mediæval warfare.

ıretion—The primary formation of resin-ducts in the bark of ıus trees has been explained by Dippel,[2] Müller,[3] and Frank,[4] sequent diffusion of the resinous juice through the heart-wood, ıd, and bark, has been elaborately investigated by Hugo von From the various forms under which this diffusion exists in the t species, have arisen the diverse methods of obtaining the :hinous resins.

ıs in the wood of the Silver Fir (*Pinus Picea* L.), resin-ducts are ıer wanting ;—and led by experience, the Alpine peasant collects ɔentine of this tree by simply puncturing the little cavities which ıder its bark. In the Scotch Pine (*P. silvestris* L.), they are more

ıchte der Chemie, iv. (1847) 392.
ıische Zeitung, 1863.
ɔheim, *Jahrb. für wissenschaftl.* 1866.
[4] *Beiträge zur Pflanzenphysiologie*, Leipzig, 1868. 119.
[5] *Botanische Zeitung*, 1869. 329.

abundant in the wood than in the bark, a fact which might be anticip by observing how rarely this tree exudes resin spontaneously.

Oil of turpentine, like volatile oils in general, undergoes on expo to the air certain alterations giving rise to what is called *resinifica* The formic acid which is produced in small quantity during change, characterizes it as one of oxidation; the chief products how are not exactly known, and not one of them has been proved iden with any natural resin. The common assumption that resins are prod from volatile oils by simple oxidation, is consequently not yet ent justified. Hlasiwetz and Barth however, have obtained subst coming extremely near to the resins of coniferous trees, by he essential oils of turpentine, juniper and the like, in sealed tubes alcoholic solution of potash.[1]

Extraction—In the United States,[2] turpentine is obtained t largest extent from *Pinus australis*, of which tree there are vast fo in North and South Carolina, Georgia and Alabama. But it is in N Carolina that the extraction of turpentine is principally carried on.

In the winter, *i.e.* from November to March, the negroes *Turpentine Orchard*, as the district of forest to be worked is calle occupied in making in the trunks of the trees, cavities which technically known as *boxes*. For this purpose a long narrow a used, and some skill is required to wield it properly. The boxes are from 6 to 12 inches above the ground, and are shaped like a dist waistcoat-pocket, the bottom being about 4 inches below the lowe and 8 or 10 below the upper. On a tree of medium size, a box sl be made to hold a quart. The less the axe approaches the centre o tree, the better, as vitality is the less endangered. An expert worl will make a box in less than 10 minutes. From one to four boxe made in each tree, a few inches of bark being left between them. greater number of trees from which turpentine is now obtained, are 12 to 18 inches in diameter, and have three boxes each.

The boxes having been made, the bark and a little of the immediately beneath it, which are above the box, are *hacked*; and this excoriation, the sap begins to flow about the middle of March, grad filling the box. Each tree requires to be freshly hacked every 8 days, a very slight wound above the last being all that is needed hacking is carried on year after year, until it reaches 12 to 15 f more, ladders being used. The turpentine, which is called d removed from the boxes by a spoon or ladle of peculiar form collected into barrels, which are made on the spot and are of very construction. The first year's flow of a new tree, having but a surface to traverse before it reaches the box, is of special goodnes is termed *Virgin dip*.

The turpentine which concretes upon the trunk is occasi scraped off and barrelled by itself, and is known in the mark *scrape*, or by English druggists as *Common Frankincense* or *Gum T*

Although a large amount of turpentine is shipped to the n ports for distillation, a still larger is distilled in the neighbourh

[1] Wiesner, *Die Gummiarten, Harze und Balsame*, Erlangen, 1869. 78.

[2] The account here given is taken from F. L. Olmsted's *Journey in the Slave States*, New York, 1856 p

turpentine orchards. Copper stills are used, capable of containing 20 barrels of turpentine. The turpentine is distilled without water, volatile oil as it flows from the worm being received in the barrel in ich it is afterwards sent to market. When all the oil that can be fitably drawn off has been obtained, a spigot is removed from an ning in the bottom of the still, and the residual *Rosin*, appearing a viscid fluid like molasses, is allowed to flow out. Only the first alities of rosin, as that obtained from *Virgin dip*, are generally sidered worth saving, the less pure sorts being simply allowed to run waste. When it is intended to save the rosin, the latter is drawn off o a vat of water, which separates the chips and other rubbish, and rosin is then placed in barrels for the market. A North Carolina pentine orchard will remain productive under ordinary treatment fifty years.

The collection of turpentine in the departments of the Landes and onde in the south-west of France, is performed in a more rational nner than in America, inasmuch as the plan of making deep cavities the tree for the purpose of receiving the resin, is avoided by the simple pedient of placing a suitable vessel beneath the lowest incision.[1] The pentine which concretes upon the stem is termed in France, *Galipot Barras*.

Description—Common turpentine is chiefly of two varieties, namely, *erican* and *Bordeaux*; the first alone is commonly found in the glish market.

American Turpentine — A viscid honey-like fluid, of yellowish our, somewhat opaque, but becoming transparent by exposure to the ; it has an agreeable odour and warm bitterish taste. When long pt in a bottle, it is seen to separate into two layers, the upper clear l faintly fluorescent, the lower somewhat turbid or granular. When latter portion is examined under the microscope, it is found to con- t mainly of minute crystals of peculiar curved or bluntly elliptic m. These crystals are abietic acid; when the turpentine is warmed, crystals are speedily dissolved.

Bordeaux Turpentine—in all essential particulars agrees with erican turpentine; it appears to separate rather more readily than the ter into two layers,—a transparent and an opaque or crystalline.

Chemical Composition—The turpentines are mixtures of resin essential oil. The latter which amounts to from 15 to 30 per cent., sists for the greater part of various hydrocarbons, all corresponding he formula $C^{10}H^{16}$. Many of the crude turpentine oils, and some of m even after rectification, are energetically acted on by metallic ium. This reaction proves the presence of a certain quantity of genated oils, not one of which has thus far been isolated.

The turpentine oils although agreeing in composition, exhibit a es of physical differences according to their origin. One and the e tree, indeed, yields from its several organs, oils of different proper-

The boiling point varies between 152° and 172° C. The sp. gr. nean temperatures ranges from 0·856 to 0·870. Greater differ- s are exhibited in the optical properties, some varieties of the

[1] For further particulars, see Guibourt, *Hist. des Drog.* i., (1869) 279.

undergoing a loss in weight; at higher temperatures, it gi
composes. Pure colophony has a sp. gr. of 1·07, and is hor
transparent, amorphous, and very brittle. At temperatures b
and 20° C., it requires for solution 8 parts of dilute alcohol (0
addition of a caustic alkali, it dissolves in spirit much more
is plentifully soluble in acetone or benzol.

The composition of colophony agrees with the formula.
By shaking coarsely powdered colophony with warm dilute al
converted into a crystalline body, *Abietic Acid*, $C^{44}H^{64}O^{5}$,—a
simply to hydration. Under such treatment, colophony yield
per cent.[2] of abietic acid, and therefore consists chiefly of the
of that acid. This is probably the case with the resins of oth
The living tree contains only the anhydride, for the fresh res
is clear and amorphous after the expulsion of the oil; and wh
to the air it loses oil, takes up water and solidifies as the cryst
—a change which may easily be traced by the aid of the r
in drops taken direct from the trunk. Amorphous colophony
transparency even in a moist atmosphere, and appears to be
passing into the state of abietic acid, only when the assump
needful molecule of water is aided, in nature by the prese
essential oil, or artificially by that of alcohol.

Colophony when boiled with alkaline solutions, forms gre
abietic acid, the so-called *resin-soaps*, which are used as a
other soaps

Siewert's *Sylvic Acid* is regarded by Maly (1864) as a pro
decomposition of abietic acid; and the *Pimaric*, *Pinic* and S
of former investigators, as impure abietic acid. Pimaric aci
which is the chief constituent of *Galipot*, appears to be decided
so far as we can judge from the experiments of Duvernoy (18
one of ourselves (F.)

Abietic acid, as well as the unaltered coniferous resins,
ray of polarized light, whereas American colophony dissolved

llowing figures, which represent the quantities imported in the .l years:—

1869	1870	1871	1872
60,408 cwt.	51,257 cwt.	2,231 cwt.	1,000 cwt.

greatly diminished importation of the crude article is partially ex-d by a larger importation of Oil of Turpentine and Rosin; but the se is by no means sufficient to account for the vast diminution indi-by the above figures. The quantities of these latter articles imported he United Kingdom during the year 1872, were as follows.—*Oil rpentine*, 220,292 cwt., value £470,085, six-sevenths being furnished : United States of America and the remainder chiefly by France. , 919,494 cwt., value £492,246; of this quantity, the United States ied nine-tenths, and France the larger part of the remainder.[1]

ses—Turpentine, Common Frankincense and Colophony are lients of certain plasters and ointments. Oil of turpentine is onally administered internally as a vermifuge or diuretic, and d externally as a stimulant. But these substances are immeasurably nportant in medicine than in the arts.

Thus Americanum vel vulgare.

is substance, known among druggists as *Common Frankincense* or *Thus*, is the resin which, as explained at p. 546, concretes upon the of the pines in the American turpentine orchards, and is there *Scrape*. It corresponds to the *Galipot* or *Barras* of the French, in old times supplied its place.

is a semi-opaque, softish resin, of a pale yellow colour, smelling pentine; it is generally mixed with pine leaves, bits of wood and impurities, so that it requires straining before it is used. By ng, it becomes dry and brittle, of deeper colour and milder odour. r the microscope, it exhibits a crystalline structure due to *Abietic* of which it chiefly consists. It is imported from America in s, but in insignificant quantities and only for the druggist's use. times however, it is distilled as common turpentine.

ry pine resin, of which Common Frankincense is the type, evolves heated an agreeable smell: hence in ancient times it was commonly in English churches in place of the more costly olibanum. At it, it is scarcely employed except in a few plasters.

TEREBINTHINA VENETA.

inthina Laricina; Venice Turpentine, Larch Turpentine; F. *Térébenthine de Venise ou de Briançon, Térébenthine du mélèze;* G. *Venetianischer Terpenthin, Lärchen-Terpenthin.*

otanical Origin—*Pinus Larix* L. (*Larix Europæa* DC.), a tall forest f the mountains of Southern Central Europe, from Dauphiny through lps to Styria and the Carpathians, ascending to an elevation of to 5500 feet above the sea-level. It is largely grown in planta-in England and Scotland.

istory—The turpentine of the larch was known to Dioscorides as ted from the Alpine regions of Gaul.[2] Pliny also was acquainted

[1] *nual Statement of the Trade of the or 1872.* pp. 53. 56. 60. 210.

[2] Lib. i. cap. 92.

with it, for he correctly remarks that it does not harden. Galen i 2nd century also mentions it, admitting that it may well be substi for Chian turpentine, then regarded as the legitimate *Terebinthina* later times, Mattioli (*circa* 1550) gave an account of the method c lecting it about Trent in the Tirol, by boring the trees to the c which is true to the present day. It used formerly to be exported Venice.

The name *larch* seems to belong to the turpentine rather than t tree. Dioscorides says the resin is called by the natives λάρικα a similar name is mentioned by Galen. In a commercial guide, *Tariffa de pesi e misure*, which first appeared at Venice in 1503, w "*Termentina sive Larga*,"—and *larga* is still an Italian name for turpentine. The peasants of the Southern Tirol call it *Lergat*, a Switzerland the common name is *Lörtsch*.

Extraction—Larch turpentine is collected in the Tirol, chiefly Meran, Botzen and Trent. A very small amount is obtained occ ally in the Valais in Switzerland, and in localities in Piedmont France where the larch is found. The resin is obtained from the l wood, by making in the spring a narrow cavity reaching to the cen the stem, at about a foot from the ground. This is then stopped up the autumn of the same or of the following year, when it is opene the resin taken out with an iron spoon. If only one hole is thus the tree yields about half a pound yearly without appreciable detri But if on the other hand a number of wide holes are made, and espe if they are left open, as was formerly the practice in the Piedmo and French Alps, a larger product amounting to as much as 8 obtained annually, but the tree ceases to yield after some years, a wood is much impaired in value.

Mohl, who witnessed the collection of this turpentine in the S Tirol,[1] observed that when a growing larch stem was sawn thro resin flowed most abundantly from the heart-wood, and in smaller qu though somewhat more quickly, from the sap-wood, and that th contained but few resin-ducts. The practice of closing the cav adopted, not only for the sake of preserving the wood and for the convenience of removing the turpentine, but also because it te maintain the transparency and purity of the latter.

Description—Venice turpentine is a thick, honey-like fluid, s turbid, yet not granular and crystalline;[2] it has a pale-yellowish and exhibits a slight fluorescence. Its odour resembles that of c turpentine but is less powerful; its taste is bitter and aromatic. exposed to the air, it thickens but slowly to a clear varnish; it d harden when mixed with magnesia. Larch turpentine though on the Continent, is seldom imported into England,[3] and the arti for it is almost always spurious.

Chemical Composition—Larch turpentine dissolves in sp wine, forming a clear liquid which reddens litmus; hot water with it also acquires a faint acid reaction, due to formic and p also to succinic acid. Glacial acetic acid, amylic alcohol, and a

[1] *Botanische Zeitung*, xvii. (1859) 329.

[2] I once met with resin in crystalline drops on the stem of a larch near Bern.—F. A. F.

[3] On one occasion I observed Ve pentine in a public drug sale in L barrels imported from Trieste being 14 July, 1864.—D. H.

ix with it perfectly. By distillation, it yields on an average 15 per ent. of essential oil of the composition, $C^{10}H^{16}$, which boils at 157° C., nd when saturated with dry hydrochloric acid gas, easily produces rystals of the compound $C^{10}H^{16} + HCl$. The residual resin is soluble n two parts of warm alcohol of 75 per cent., and more copiously in oncentrated alcohol.

Two parts of the turpentine diluted with one of benzol or acetone, eviate the ray of polarized light 9·5° to the *right*. The essential oil eviates 6·4° to the *left*; the resin perfectly freed from volatile oil and issolved in half its weight of acetone, deviates 12·6° to the *right*, in a olumn 50 mm. long.

We have not succeeded in preparing a crystallized acid from the esin of Venice turpentine, although its composition according to *Maly* 1864), is the same as that of American colophony, which is easily transormed into crystallized abietic acid.

Uses—Venice turpentine appears to possess no medicinal properties hat are not equally found in other substances of the same class, and as a medicine it has fallen into disuse. But in name at least, it is in frequent requisition for horse and cattle medicines.

Adulteration—Alston (1740–60) said of Venice turpentine[1] that it s seldom found in the shops,—a remark equally true at the present day, or but few druggists trouble themselves to procure it genuine. The Venice turpentine usually sold is an artificial mixture of common resin nd oil of turpentine, which may be easily distinguished from the product f the larch by the facility with which it dries when spread on a piece of aper,[2] and by its stronger turpentine smell.

CORTEX LARICIS.

Larch Bark.

Botanical Origin—*Pinus Larix* L.—see p. 549.

History—The bark of the larch has long been known to possess stringent properties; hence it has been used in tanning. Gerarde,[3] who rote near the close of the 16th century, likened it to that of the pine, hich he described to be of a binding nature; but there is no evidence at it was an officinal drug.

About the year 1858, larch bark was recommended by Dr. Frizell of ublin, and afterwards by other physicians, as a stimulating astringent nd expectorant. In consequence of the favourable effects which have sulted from its use, it has been included in the *Additions to the Pharmacopœia of* 1867, published during the present year.

Description—The bark that we have seen is in flattish pieces or ge quills, externally reddish-brown. In those taken from older wood, ere is a large amount of an exfoliating corky coat, displaying as it is moved, bright rosy tints, while the liber is of a different texture, slightly rous and whitish. The inner surface is smooth and of a pinkish brown,

Lectures on the Materia Medica, Lond. 1770. 398.

Thus if a thin layer of true Venice turtine and another of common turpentine pread on two sheets of paper, it will be d after the lapse of some weeks that the former cannot be touched without adhering to the fingers, while the latter will have become a dry, hard varnish.

[3] *Herball, enlarged by Johnson*, Lond. 1636. 1366.

or pale yellow. The bark breaks with a short fracture, exhaling an agreeable balsamic terebinthinous odour; it has a well-marked astringent taste. For medicinal use, the inner bark is to be preferred.

Microscopic Structure—A transverse section exhibits resin-ducts, but far less numerous than in the bark of many allied trees. The medullary rays are not very distinct. Throughout the middle layer of the bark, large isolated thick-walled cells of very irregular shape are scattered.

Chemical Composition—Larch bark has been examined by Stenhouse,[1] who finds it to contain a considerable amount of a peculiar tannin, yielding olive-green precipitates with salts of iron. The same chemist also discovered[2] in larch bark an interesting crystallizable substance called *Larixin* or *Larixinic Acid*, which has the composition, $C^{10}H^{10}O^5$. It may be obtained by digesting the bark in water at 80° C. and evaporating the infusion to a syrupy consistence. From this by still further cautious heating in a retort, the larixin may be distilled, during which operation some of it crystallizes on the inner surface of the receiver, the remainder being dissolved in the distilled liquor. From the latter it may be obtained in crystals by evaporation. The substance forms colourless crystals, sometimes as much as an inch long; it volatilizes even at 93° C., and melts at 153°. It requires about 80 parts of water for solution at 15° C., but more freely dissolves in boiling water or in alcohol. From ether, in which it is but sparingly soluble, it separates in brilliant crystals. The solutions have a bitterish astringent taste and a slightly acid reaction, and assume a purple hue on addition of ferric chloride. When a solution of baryta is added to a concentrated solution of larixin, the latter being in excess, a bulky gelatinous precipitate falls; it is readily soluble in boiling water and is deposited again on cooling. Larixin is allied to pyrogallol and pyrocatechin, but differs from both in that it exists ready formed, and is an educt, not a product. Stenhouse failed to obtain it either from the bark of *Pinus Abies* L., or from that of *P. silvestris* L.

Uses—Larch bark, chiefly in the form of tincture, has been prescribed to check profuse expectoration in cases of chronic bronchitis; it has also been found useful in arresting internal hæmorrhage.

TEREBINTHINA CANADENSIS.

Balsamum Canadense; Canada Balsam, Canadian Turpentine; F. Térébenthine ou Baume de Canada; G. Canada-Balsam.

Botanical Origin—*Pinus balsamea* L. (*Abies balsamea* Marshall), the Balsam Fir or Balm of Gilead Fir, a handsome tree, 20 to 40 feet high, with a trunk 6 to 12 inches in diameter, sometimes attaining still larger dimensions, growing in profusion in the Northern and Western United States of America, Nova Scotia and Canada, but not observed beyond 62° N. lat. It resembles the Silver Fir of Europe (*Pinus Picea* L.), but has the bracts short-pointed and the cones more acute at each end

[1] *Proceedings of the Royal Society*, xi. (1862) 404.

[2] *Phil. Trans.*, vol. 152 (1862) 53.—We write the name *Larixin* instead of *Larix*, with the concurrence of Dr. Stenhouse

Canada balsam is also furnished by *Pinus Fraseri* Pursh, the Small-ted or Double Balsam Fir, a tree found on the mountains of Penn-sania, Virginia, and southward on the highest of the Alleghanies.[1]
Pinus Canadensis L. (*Abies Canadensis* Michx.), the Hemlock Spruce Vérusse, a large tree abundant in the same countries as *P. balsamea*, extending throughout British America to Alaska, is said to yield a lar turpentine, which however has not yet been sufficiently examined. Hemlock Spruce is of considerable importance on account of the a collected from its trunk, and the essential oil distilled from its ge, the latter operation being performed on a large scale in Madison nty, New York. The inner bark of the tree is a valuable material anning.

History—Lewis, in his *History of the Materia Medica* published in l, says that "*an elegant balsam*" obtained from the Canada Fir, is etimes brought into Europe under the name of *Balsamum Canadense*. ada balsam was first introduced into the London Pharmacopœia in 8. From the books of a London druggist, J. Gurney Bevan, we find its wholesale price in 1776 was 4*s.*, in 1788, 5*s.* per ℔.

Description—Canada balsam is a transparent resin of honey-like istence, and of a light straw-colour with a greenish tint. By keeping, owly becomes thicker and of a somewhat darker hue, but always ins its transparency. When carefully examined in direct sunlight, thibits a slight greenish fluorescence in the same degree as other entines or as copaiba; this optical power appears to increase if the am is exposed to a heat of about 200° C.
Canada balsam has a pleasant aromatic odour and bitterish, feebly l, not disagreeable taste. On account of its flavour it is sometimes d *Balm of Gilead*, but erroneously, as this latter is derived from a of the genus *Balsamodendron* growing in Arabia. We found a good nercial balsam to have a sp. gr. of 0·998 at 14·5° C., water at the temperature being 1·000. Four parts, mixed with one of benzol examined in a column of 50 mm. in length, deviated a ray of ized light 2° to the right. The balsam is perfectly soluble in any ortion in chloroform, benzol, ether, or warm amylic alcohol; and olution in each case reddens litmus. With sulphide of carbon, it s readily, but the mixture is somewhat turbid. Glacial acetic acid, ne or absolute alcohol dissolve the balsam partially, leaving after ition and cooling, a considerable amount of amorphous residue. ohony and Venice turpentine are completely dissolved by the ls in question, as well as by spirit of wine containing 70 to 75 per of alcohol.

hemical Composition[2]—Like all analogous exudations of the *ees*, Canada turpentine is a mixture of resins with an essential oil. e latter is allowed to evaporate, the former are left as a transparent what tough and elastic mass. The proportion of the components is n certain limits, variable in different samples. The specimen before-ioned lost after an exposure in a steam-bath during several days, no

[1] Gray, *Botany of the Northern United* New York, 1866. 422.

[2] The experiments detailed under this head were performed by Dr. F.

less than 20 per cent. of volatile oil, or even 24 per cent. if th ment was made on a very small scale, as with 20 grammes or thin layer.

By distillation with water, it is not easy to obtain more th 18 per cent. of essential oil. The resin in this case is a tough non-transparent mass, retaining obstinately a large proportion o which can only be removed by keeping it for some time at a t ture of 100°–176° C.

The oil as obtained by distillation with water is colourless, the odour of common oil of turpentine rather than the agreeab of the balsam; it consists of an oil, $C^{10}H^{16}$, mixed with an insig proportion of an oxygenated oil, the presence of which may be pr the slight evolution of hydrogen on addition of metallic sodiu the oil has been freed from water by contact with fused chl calcium. After this treatment, a small proportion begins to d about 160° C., but by far the larger part boils at 167° C., a small only distilling at last at 170° C. and above. The oil obtained examined under the conditions already mentioned, has a sp. gr. of and the power of rotating a ray of polarized light, 5·6° to t The portion distilling at 160° does not differ in this respect; b passing over at 170°, deviates the ray 7·2° to the left. The oil dissolves a large proportion of glacial acetic acid; an equal we each mixes perfectly at about 54° C., but some acetic acid separ cooling.

The essential oil of Canada balsam, saturated with dry hydro acid, does not yield a solid crystallizable compound; but this is obtained on addition of fuming nitric acid and gently heating, wh inside of the retort becomes covered by sublimed crystals of $C^{10}H^{16}$.

Thus, this oil in its general characters, bears a close resemblance essential oils of the cones of *Pinus Picea* L., and of the leaves of *P. l* Hänke, and to most of the French varieties of oil of turpentine. than to the American turpentine oils, which rotate to the righ combine immediately with H Cl to form a solid crystalline compo

On the other hand, the resin of Canada balsam is dextrogy parts of it, entirely deprived of essential oil and dissolved in one of deviating the ray 8·5° to the right. The optical powers of the tw ponents (oil and resin) are therefore antagonistic.

The resin of Canada balsam consists however of two different 78·7 per cent. of it being soluble in boiling absolute alcohol, an (in our specimen) remaining as an amorphous mass, readily sol ether. Neither the alcoholic nor the ethereal solution yields a cry residue if allowed to evaporate. They redden litmus, but we c succeed in obtaining any crystallized resinous acid, such as crystals of which are so readily formed if common turpentine or phony is digested with dilute alcohol. Glacial acetic acid acts u resins like absolute alcohol. Caustic alkalis do not dissolve eit balsam or the resin; the former however is considerably thicke incorporation with ⅓ of its weight of recently calcined magnesi the mixture, moistened with dilute alcohol, is kept at 93° C. for days and frequently stirred, a mass of hard consistence, finally lucent, results. Caustic ammonia heated with the balsam in a bottle, forms a thick milky jelly, which does not afterwards separ

Hence, according to our investigations, 100 parts of Canada turpentine consist of

Essential oil, $C^{10}H^{16}$, with a very small proportion of an oxygenated oil	24
Resin soluble in boiling alcohol	60
Resin soluble only in ether	16

The result of Wirzen's examination of Canada balsam[1] are not in complete accordance with those here stated. He found 16 per cent. of oil and three different amorphous resins, one of which had the composition of abietic acid.

Production and Commerce—Canada balsam is obtained either by puncturing the vesicles which form under the bark of the trunk and branches, and collecting their fluid contents in a bottle, or by making incisions. It is obtained principally in Lower Canada, and is shipped from Montreal and Quebec, in kegs or large barrels. In the neighbourhood of Quebec, about 2000 gallons (20,000 lb.) used to be collected annually; but in 1868, owing to distress among the farmers, the quantity obtained was unusually large, and it was estimated that nearly 7000 gallons would be exported to England and the United States.[2] During a recent scarcity (1872–73) a sort of balsam from Oregon has been substituted in the American market for true Canada balsam.[3]

Uses—The medicinal properties of Canada balsam resemble those of Copaiba and other terebinthinous oleo-resins, yet it is now rarely employed as a remedy. The balsam is much valued for mounting objects for the microscope, as it remains constantly transparent and uncrystalline. It is also used for making varnish.

TEREBINTHINA ARGENTORATENSIS.

Strassburg Turpentine ; F. Térébenthine d'Alsace ou de Strasbourg, Térébenthine du sapin ; G. Strassburger Terpenthin.

Botanical Origin—*Pinus Picea* L. (*Abies pectinata* DC.), the Silver fir,[4] a large handsome tree, growing in the mountainous parts of Middle and Southern Europe from the Pyrenees to the Caucasus, and extending under a slightly different form (var. *β. Cephalonica*) into continental Greece and the islands of Eubœa and Cephalonia.

History—Belon in his treatise *De Arboribus coniferis* (1553) described this turpentine, which is also briefly yet accurately noticed by Samuel Dale,[5] a learned apothecary of London and the friend of Sloane and Ray. It had a place in the London Pharmacopœia until 1788, when it was omitted from the materia medica.

Extraction—The resin of *P. Picea*, like that of *P. balsamea*, is contained in little swellings of the bark of young stems, and is extracted by

[1] *De balsamis et præsertim de Balsamo canadense*, Helsingforsiæ, 1849, abstracted in the *Jahresbericht* of Wiggers for 1849. 38.

[2] From information obligingly communicated by Mr. N. Mercer of Montreal and Mr. Sugden Evans of London.

[3] *Proceedings of the American Pharmaceutical Association*, Philadelphia, 1873. 119—also 1874. 433.

[4] *Sapin* in French; *Weisstanne* or *Edeltanne* in German.

[5] *Pharmacologia*, Lond. 1693. 395.

:ed throughout Northern and the mountainous parts of Central but not indigenous to Great Britain, though extensively planted. ian Lapland, it reaches at 68° N. lat., almost the extreme limit regetation, while southward it extends to the Spanish Pyrenees. Alps, it ascends to 6000 feet above the level of the sea.

tory—In accordance with the definition of the London Pharma- and the custom of English druggists, the name *Burgundy Pitch* ted to the product of the above-named species. The pharmaco- f France use an equivalent term with the same limitations: but parts of the Continent, *Pix Burgundica* has a wider meaning, llowed to include the turpentines of other *Coniferæ*. We here it in the English sense.

:inson, an apothecary of London and herbarist to King Charles I., of "*Burgony Pitch*" as a thing well known in his time.[1] Dale *harmacologia* (1693) mentions *Pix Burgundica* as being imported gland from Germany, and it is also noticed by Salmon (1693), s "it is brought to us out of Burgundy, Germany and other ear Strasburgh."[2]

et, writing in Paris about the same period, discards the prefix *ly* as a fiction, remarking that the best *Poix grasse* comes from and Strassburg.[3]

ther this resin ever was collected in Burgundy, we are unable to ie. It may probably have acquired the name through having ought into commerce from Switzerland and Alsace, by way of Comté, otherwise called Comté de Bourgogne or Haute ne.[4]

undy pitch is enumerated among the materia medica of the Pharmacopœia of 1677, and in every subsequent edition. In 1809, it was defined under the name of *Pix arida*, as the *pre- sin of Pinus Abies.*

duction—Burgundy pitch is produced in Finland, in the Black n the Grand Duchy of Baden, Austria and Switzerland. On te of Baron Linder at Svarta near Helsingfors, it is obtained by the crude resin in contact with the vapour of water, and g. The quantity annually produced there, was stated in 1867 to 0 kilogr. (689 cwt.)[5]; that afforded by an establishment at Ilm ame country, amounted to 80,000 kilogr. (1575 cwt.).[6]

he neighbourhood of Oppenau and on the Kniebis mountain in id Duchy of Baden, the stems of the firs are wounded at equal s by making perpendicular channels, 1½ inches wide and the depth. The resin which exudes from these channels, is scraped an iron instrument made for the purpose, and purified by being in hot water, and strained. This is performed in three or ll establishments at Oppenau and the neighbouring village of erg. In this state the resin, which is opaque and contains much

r of Plants, 1640. 1542.
eat English Physician, 1693. 1031.
des Drogues, Paris, 1694. part i.

eus in his *Stirpium Sciagraphia* marks that he had seen the *Pesse* [*P. Abies* L.] in great plenty "*in Burgundicis montibus*," yet makes no particular allusion to it yielding resin.

[5] *Pharm. Journ.* ix. (1867) 164.

[6] *Oesterreichischer Ausstellungs-Bericht*, x. (Wien, 1868) 471.

moisture, is called *Wasserharz*. By a further straining and evapo a portion of the water, its quality is improved.

The manufacture in that part of Germany is on the decline, pa consequence of the timber being injured by the wounding of the so that the collecting of resin is not permitted in the large belonging to the governments of Baden and Würtemberg. W had the opportunity of observing[1] that in the establishments in qu French turpentine or *galipot*, imported from Bordeaux, as w American rosin or colophony, are used in quantities certainly ex that of the resin grown on the spot.

In the middle of the last century, some Burgundy pitch wa duced, according to Duhamel[2] in the present canton of Neuchât no such branch of industry is now pursued there, at least on a scale. On the other hand, in the districts of Moutier and Delém the Bernese Jura, this resin is still collected though it is not kn *Burgundy Pitch*, but is termed simply *Poix blanche* (White Pitch) surveyor of the forests of this district, which is one of the rich *Pinus Abies*, has informed one of us that from 790 to 850 quinta collected, and exported to Basle, Zürich, Aarau and Vaud. The is worth *in loco* (1868), 100 to 110 francs (£4 to £4 8s.) the *bos* quintals. The quantities collected in other parts of Switzerland ar less considerable.

Description—Pure Burgundy pitch, of which we have nun authentic specimens, is a rather opaque, yellowish-brown substanc and brittle when cold, yet gradually taking the form of the ves which it is kept. It is strongly adhesive, breaks with a clear conc fracture, and has a very agreeable, aromatic odour, especially heated. It does not exhibit a crystalline structure, although, as w frequently observed, the resin on the stem of the tree is d crystalline.

Burgundy pitch is readily soluble in glacial acetic acid, a absolute alcohol, and even in alcohol of 75 per cent. (sp. gr. 0·8 its solubility in these liquids is considerably altered by the pres water or essential oil; and still more by the formation of abietic a the resin itself. The same influences also affect the melting poi

The crude resin of *Pinus Abies*,[3] deprived of essential oil an solved in one part of absolute alcohol, was found to deviate a r polarized light 3° to the left, in a column of 50 mm.; the essen deviated 8·5° to the same direction. The oil contains a small am an oxygenated oil. After treatment with sodium, the oil which re does not form a solid compound if saturated with hydrochloric a

Chemical Composition—The investigations of Maly men at p. 548 afford a satisfactory elucidation of the chemical prope the pinic resinous exudations. They all, according to that chem mixtures of the same amorphous resin, $C^{44}H^{62}O^{4}$, with essential the composition $C^{10}H^{16}$. These terebinthinous juices are collec sold either in their natural state as *turpentine*, or deprived more completely of their volatile oil, in which condition they are repr by *Burgundy Pitch*, and finally by *rosin* or *colophony*.

[1] I spent several days in the localities in 1873.—F. A. F.

[2] *Traité des Arbres*, etc. i. 1755.

[3] Collected by myself.—F. A. F.

pentines flowing down the stems of the trees, gradually lose parency if allowed to dry slowly in the air, becoming at the harder and somewhat granular. This alteration is due to the on of water, which at last is not only mixed with the com- the resinous juice, but to some extent combines chemically esin so as to transform it into a crystalline body having the of an acid. The fact is easily observed if clear drops of the of *Pinus silvestris*, *P. Abies* or *P. Picea* are collected in vials perfectly dry. Thus treated, these turpentines remain trans- t the addition of water causes after a short time the formation copic crystals of abietic acid, rendering them more or less

entines are collected before they lose their essential oil by n and oxidation, and before they have become crystalline, they tained perfectly transparent by distilling off the volatile oil ater. The distillation being most commonly carried on *with* remaining resin is opaque.

s of opinion that the same amorphous resin occurs in all the and that it yields by hydration the same acid, namely *Abietic*, s been described by former chemists as *Pinic*, *Sylvic* and cids, all of which indeed are admitted to have the same com- We must however remember that several sorts of turpentine, Balsam, appear incapable, according to our experiments, of ny crystalline resinoid compound whatever; and that their s resin being but partially soluble, is certainly not a homo- ubstance.

ystals as formed naturally in the common turpentines, do not ecisely the same forms as those obtained artificially, when the agitated with warm diluted alcohol, as in the preparation of d. As to *Pimaric Acid*, we have prepared it in quantity from e resin of *Pinus Pinaster*, but have always found its crystalline entirely different from that of abietic acid.[1]

re inclined, therefore, to think that the composition of the *Coniferæ* is not so uniform as Maly suggests. The remarkable their essential oils is a fact which seems in favour of

—Burgundy pitch is prescribed as an ingredient of plasters, employed is useful as a mild stimulant. In Germany, it has omic applications, one of which is the lining of beer-casks, for rpose a composition is used called *Brauerpech* (brewers' pitch), mixing it with colophony or *galipot*.

teration—No drug is the subject of more adulteration than pitch, so much so that the very name is understood by some logists to be that of a manufactured compound. The substance sold in England, is made by melting together colophony n oil or some other fat, water being stirred in to render the opaque. In appearance it is very variable, different samples g different shades of bright or dull yellow or yellowish-brown. en broken exhibit numerous cavities containing air or water; ore or less opaque, becoming in time transparent on the surface

[1] *Jahresbericht* of Wiggers and Husemann for 1867. 37.

by the loss of water. Artificial Burgundy pitch is offered for t bladders; it has a weak terebinthinous odour and is devoid peculiar fragrance of the genuine. The presence of a fatty oil is discovered by treatment with double its weight of glacial aceti which forms a turbid mixture, separating by repose into two laye upper being oily.

PIX LIQUIDA.

Wood Tar; F. *Goudron végétal, Poix liquide;* G. *Holztheer, Fichte*

Botanical Origin—Tar is obtained by submitting the wood stems and roots of coniferous trees to dry or destructive distil That found in commerce is produced in Northern Europe, chiefl two species, namely *Pinus silvestris* L. and *P. Ledebourii* Endl. (*Sibirica* Ledeb.) These trees constitute the vast forests of . Europe and Asia.

History—Theophrastus gives a circumstantial description o preparation of tar, which applies with considerable accuracy to th cesses still practised in those districts where no improved meth manufacture have yet been introduced.

Production—The great bulk of the vegetable tar used in E and known in commerce as *Archangel* or *Stockholm Tar*, is prepar Finland, Central and Northern Russia, and Sweden.

The process is conducted in the following manner:—vast sta pine wood consisting chiefly of the roots and lower portions of the t (the more valuable parts of the trees being used as timber), and taining as much as 30,000 to 70,000 cubic feet, are carefully p together, and then covered with a thick layer of turf, moss, and beaten down with heavy stampers. The whole stack of billets is structed over a conical or funnel-like cavity made in the grou possible on the side of a hill, this arrangement being adopted f purpose of carrying on a downward distillation. Fire being ap the combustion of the mass of wood has to be carried on very s and without flame, in order to obtain the due amount of tar. charcoal of good quality. During its progress, the products, chiefl collect in the funnel-like cavity, from which they are discharg tube into a cast-iron pan placed beneath the stack, or simply hollow tree trunks. The time required for combustion varies one to four weeks, according to the size of the stack.

During the last few years, this rude process has been improve accelerated by the introduction of rationally constructed wrought stills, furnished with refrigerating condensers, as proposed in Rus Hessel in 1861. By this mode of manufacture, the yield in tar f wood, is about 14 per cent. from stems, dried by exposure to the air; and 16 to 20 per cent. from roots. Large quantities of pyrol acid and oil of turpentine are at the same time secured. The w the beech and of other non-coniferous trees, appears not to afford than 10 per cent. of tar, while turf yields only from 3 to 9 per ce

Description—The numerous empyreumatic products which from the destructive distillation of pine wood, and which we c

nstitute a dark brown or blackish semi-liquid substance, of peculiar lour and sharp taste. When deprived of water and seen in thin yers, tar is perfectly transparent. The magnifying glass shows some the varieties to contain colourless crystals of *Pyrocatechin*, scattered roughout the dark viscid substance, and to these tar owes its occasionly granular, honey-like consistence.[1] A gentle heat causes them to elt and mix with the other constituents.

True vegetable tar has always a decidedly acid reaction. It is adily miscible with alcohol, glacial acetic acid, ether, fixed and volatile ls, chloroform, benzol, amylic alcohol or acetone. It is soluble in austic alkaline solutions, but not in pure water or watery liquids. The . gr. of tar from the roots of conifers is about 1·06 (Hessel), yet at a omewhat elevated temperature, it becomes lighter than warm water.

Water agitated with tar acquires a light yellowish tint, and the taste nd odour of tar, as well as an acid reaction. On evaporation the olution becomes brown, and at last microscopic crystals are obtained ith a brown residue like tar itself, which is no longer soluble in water. microscopical examination of tar which has been exhausted with ater, shows that all crystals have disappeared.

Chemical Composition—Dry wood may be heated to about 150° C. ithout decomposition; but at a more elevated temperature, it comences to undergo a change, yielding a large number of products, e nature and comparative quantity of which depend upon circumances. If the process is carried on in a closed vessel, a residue will e got which has more or less resemblance to coal. By heating fir-wood closed with some water to 400° C., Daubrée (1857) obtained a coalke substance, which yielded by a subsequent increase of temperature arcely any volatile products.

The results are widely different if a process is followed which permits e formation of volatile bodies; and these substances are formed in rgest proportion, if the heat acts quickly and intensely. At lower grees of heat, more charcoal results and more water is evolved.

Among the volatile products of destructive distillation, those alone hich are condensed at the ordinary temperature of the air are of armaceutical interest; and of these, chiefly the portion not soluble in ater, or that which is called *Tar* or *Liquid Pitch*. The aqueous portion the products consists principally of empyreumatic acetic acid, to hich tar owes its acid reaction.

The tissue of wood is chiefly formed of cellulose, intimately combined th a saccharine substance, which may be separated if the wood is iled with dilute acids. The remaining cellulose is however not yet re, but is still united to a substance which, as shown by Erdmann,[2] capable of yielding pyrocatechin.

It is well known that sugar subjected to an elevated temperature, lds a series of pyrogenous products; and the same fact is observed purified cellulose is heated in a similar manner. But for tar-making, d is preferred which is impregnated with resins and essential oils, these latter furnish another series of empyreumatic products. From

[1] The crystals are a pretty object for the scope, when examined by polarized

[2] Liebig, *Annalen der Chemie u. Pharmacie*, Suppl. v. (1867) 229.

these circumstances, the components of wood-tar are of an extr complicated character, which is still more the case when other than those of conifers form part of the material submitted to d tion. In the case of beechwood, *Creasote* is formed, which is ob only in very small quantity from the *Coniferæ*. Volatile alkaloi carbolic acid, which are largely produced in the destructive disti of coal, appear not to be present in wood-tar.

The components of the latter may be considered under two —first, the *lighter aqueous portion*, which separates from the products of distillation, forming what is called *Impure Pyrol Acid*. This contains chiefly acetic acid and *Methyl Alcohol* or *Naphtha*, CH^4O; *Acetone*, C^3H^6O; *Mesit*, $C^6H^{12}O^2$; *Furfurol*,[1] C^5 besides other liquid products abundantly soluble in water and acid. In this portion, some pyrocatechin also occurs.

The second class of pyrogenous products of wood, consists homologous series of liquid hydrocarbons, sparingly soluble in and which therefore are chiefly retained in the heavy layer belo pyroligneous acid, forming the proper wood-tar. The liquid in qu furnishes the following compounds:—*Toluol* or *Toluene* C^7O^8 (b point 114° C.), *Xylene* C^8H^{10}, *Cumol* or *Cumene* C^9H^{12} (148° C.), C^9H^{12} (160°.)

The wood of the beech which is employed in some countri making tar yields *Creasote*, consisting chiefly of *Creosol* $C^8H^{10}O^2$, b at 219° C.; while that of the pine affords some oil of turpenti pyrogenous oils of the same formula. Besides all these well-de bodies, tar contains several less known and not yet perfectly iso compounds, such as *Capnomor*, *Eupione*, *Assamar* &c.

If tar is redistilled, an elevated temperature being used towar end of the process, some crystallizable solid bodies are obtaine most important of which is that called *Paraffin*, having the fo C^nH^{2n}, *n* varying from 20 to 24. *Naphthalene*, $C^{10}H^8$, and *Anth* $C^{14}H^{10}$, also occur under the same circumstances.

The crystals already mentioned as occurring in tar are *Pyro* They are easily sublimed at some degrees above their fusing (111° C.), or removed by acetic acid, in which as well as in wate are readily soluble. Hence in some sorts of tar this substance do occur, it having probably been removed by water.

Pyrocatechin, $C^6H^6O^2$, can be obtained by the destructive distil of many other substances, as catechu, kino, the extracts of rhatany bearberry leaves, and other extracts rich in that form of tannin w produces *greenish* (not *blue-black*) precipitates in salts of iron. extracted from the granular sorts of wood-tar, by exposing the proper temperature to a current of heated dry air, or by exh them with water. Ether when shaken with the concentrated a solution and left to evaporate, leaves colourless crystals of pyroca which after purification are devoid of acid reaction. They have a p burning persistent taste, and are very pungent and irritating allowed to evaporate. A solution of pyrocatechin yields with perch of iron, a dark green coloration changing to black after a few m

[1] This aromatic liquid being found in the destructive distillation of sugar, it is very probable that it must also exist among the products of wood, as pine timber co cellulose combined with sugar.

ıd becoming red on the addition of potash. This mixture finally :quires a magnificent violet hue, like a solution of alkaline permanıate. No alteration is produced in a solution of pyrocatechin by otosalts of iron.

Among the few medicinal preparations of tar, is *Tar Water*, called *qua vel Liquor Picis*, made by agitating wood-tar with water. The esence in it of pyrocatechin is easily proved by the above-mentioned actions, or by a few drops of red chromate of potassium which produces brownish black coloration. It may hence be inferred that pyrocatechin perhaps the active ingredient in tar-water, and that for making this quid, the granular, crystalline sorts of tar should be preferred.[1]

Commerce—Tar as well as pitch is manufactured in Finland, and ipped from various ports in the Gulf of Bothnia, as Uleaborg, Gamla arleby, Jacobstad, Ny Carleby and Christinestad; also from Archangel ıd Onega on the White Sea. Some tar is also produced in Volhynia, ıd finds its way by the Dnieper to the Black Sea.

The North of Sweden likewise produces tar, chiefly about Umea and ıea, the distillation being now performed in well-constructed apparatus iron.

The pine forests of North America afford tar and pitch. Wilıngton in North Carolina exported in 1871, 25,260 barrels of tar, and 88 barrels of pitch.[2]

The imports of tar into the United Kingdom in 1872, were 189,291 rrels, valued at £218,339. Of this quantity, 145,483 barrels were ıipped from the northern ports of Russia.

The barrels in which tar arrives hold about 30 gallons. Smaller ted vessels termed *half-barrels* are also used, though less frequently.

Uses—In medicine of no great importance: an ointment of tar is a ıamon remedy in cutaneous diseases, and tar water is sometimes taken ernally. The consumption of tar in ship-building and for the eservation of fences, sufficiently explains the large importations.

Other Varieties of Tar.

Juniper Tar, *Pyroleum Oxycedri, Oleum Juniperi empyreumaticum, eum Cadinum, Huile de Cade.*—This is a tar originally obtained by destructive distillation of the wood of the *Cade*, *Juniperus Oxycedrus* a shrub or small tree, native of the countries bordering the Mediterean. It was formerly used in the South of France as an external ıedy, chiefly for domestic animals, but had fallen into complete ivion until a few years ago, when it began to be prescribed in skin ıplaints.

The *Huile de Cade* now in use, is transparent and devoid of crystals. s somewhat thinner than Swedish tar, but closely agrees with it in r respects. It is imported from the Continent, but where made from what wood, we know not. *Huile de Cade* is mentioned by

[1] We may suppose that the authors of the ıh *Codex* were not of this opinion, inasas in making *Eau de Goudron*, they that the liquid obtained by the first ation of the tar, shall be thrown away.

[2] Consul Walker, *Report on the Trade of North and South Carolina*—*Consular Reports* presented to Parliament, May, 1872.

Olivier de Serres,[1] a celebrated French writer on agriculture of the century; it is named by Parkinson[2] in 1640; also by Pomet[3] in time (1694) it was rarely genuine, common tar being sold in its p

Beech Tar—Tar is also manufactured from the wood of the *Fagus silvatica* L., and has a place in some pharmacopœias as th source of creasote.

Birch Tar—is made to a small extent in Russia, where called *Dagget*, from the wood of *Betula alba* L. It contains an abun of pyrocatechin, and is esteemed on account of its peculiar odou known in the Russia leather. A purified oil of birch tar is so the Leipzig distillers.

PIX NIGRA.

Pix sicca vel solida vel navalis; Pitch, Black Pitch; F. *Poix* G. *Schiffspech, Schusterpech, Schwarzes Pech.*

Botanical Origin—see *Pix liquida.*

Production—When the crude products of the dry distillati pine wood, as described in the previous article, are submitted to r tillation, the following results are obtained. The first 10 to 15 per of volatile matter, consists chiefly of methylic alcohol and aceton higher temperature causes the vaporization of the acetic acid, whil still retains the tar. This last subjected to a further distillation, m separated into a liquid portion called *Oil of Tar* (*Oleum Picis liq* and a residuum which on cooling, hardens and forms the product notice, namely *Black Pitch*. Again heated to a very elevated temper it is capable of yielding paraffin, anthracene and naphthalene.

Description—Pitch is an opaque-looking, black substance, bre with a shining conchoidal fracture, the fragments showing at the translucent edges a brownish colour. No trace of distinct crystalli is observable when very thin fragments are examined, even by pol light. Pitch has a peculiar disagreeable odour, rather different that of tar. Its alcoholic solution has a feeble taste somewhat lik of tar, but pitch itself when masticated is almost tasteless. It softe the warmth of the hand and may then be kneaded. It readily dis in those liquids which are solvents of tar. Alcohol of 75 per cent freely on it, leaving behind in small proportion a dark viscid re The brown solution reddens litmus paper, and yields a dingy bro precipitate with perchloride of iron, and whitish precipitates alcoholic solution of neutral acetate of lead, or with pure water. dissolves in solution of caustic potash, evolving an offensive odour.

Chemical Composition—From the method in which pitch is pared, we may infer that it contains some of the less volatile and crystallizable compounds found in tar.

According to Völckel, the pitch of beechwood boiled with a ca alkali, yields a fœtid volatile oil; when this solution is acidulated. volatile acids are evolved. These principles however have not yet

[1] *Théâtre d'Agriculture*, Paris, 1600. 941.
[2] *Theatrum Botanicum*, 1033.
[3] *Hist. des Drogues*, Paris, 1694. p chap xii. xiv.

ither from the pitch of pine or beech, nor has any other con- f the bulk of the drug been separated. The whitish compound y acetate of lead in an alcoholic solution of pitch deserves ion, and perhaps might be the starting point for acquiring nowledge of the chemistry of this substance.

nerce—The same countries that produce tar, produce also he quantity of the latter imported into the United Kingdom 72 was 35,482 cwt., four-fifths of which were supplied by Russia. lso manufactured from tar in Great Britain.

—Pitch is occasionally administered in the form of pills, or as an ointment, but its medicinal properties are, to say the y questionable.

FRUCTUS JUNIPERI.

el Galbuli Juniperi; Juniper Berries; F. *Baies de Genièvre;* G. *Wachholderbeeren, Kaddigbeeren.*

nical Origin—*Juniperus communis* L., a diœcious evergreen. in Europe from the Mediterranean to the Arctic regions and it Russian Asia; found also in North America. Dispersed vast area, the Common Juniper presents several varieties. In and in the greater part of Europe, it forms a bushy shrub from t high; but in the interior of Norway and Sweden it becomes rest tree of 30 to 36 feet, often attaining an age of hundreds In high mountain regions of temperate Europe and in Arctic it assumes a decumbent habit (*Juniperus nana* Willd.), rising v inches above the soil.

ory—The fruits of juniper, though by no means exclusively *communis*, were commonly used in medicine by the Greek and s well as by the Arabian physicians; and are mentioned in he earliest printed herbals. The oil was distilled by Schnellen- early as 1546.

ar uses were formerly assigned in various parts of Europe to erries. They were employed as a spice to food;[3] and a spirit, wormwood was an ingredient, was obtained from them by ion and distillation. This spirit called in French *Genièvre*, became English as *Genevra*, a name subsequently contracted into *Gin*.[4]

iption—The flowers form minute axillary catkins; those of plant consist of 3 to 5 whorls of imbricated bracts. Of these, most three soon become fleshy and scale-like, and alternate upright ovules having an open pore at the apex. After the ave faded, these three fleshy bracts grow together to form a fruit termed a *galbulus*, which encloses three seeds. The three l sutures of the fruit-scales are conspicuous in the upper part ung fruit; but after maturity the sutures alone are visible,

er, *Culturpflanzen Norwegens*, 1862 55.
buch, Konigsberg, 1556. 35.
t de Bomare, *Dict. d'Hist. nat.*

[4] The gin distilled in Holland is flavoured with juniper berries, yet, as we are told, but very slightly, only 2 lb. being used to 100 gallons.

are small prominent sacs growing out into the sarcocarp. E
bears on its inner side 1 or 2, and on its convex outer surface,
these sacs, which in old fruits contain the resinified oil in an a
colourless state.

Juniper berries when crushed have an aromatic odour and
sweetish, terebinthinous taste.

Microscopic Structure—The outer layer of the fruit c
a colourless transparent cuticle, which covers a few rows of la
or tabular cells having thick, brown, porous walls. These cell
a dark, granular substance and masses of resin. The sarcoca
in the ripe state consists of large, elliptic, thin-walled, loosely
cells, contains chlorophyll, drops of essential oil and a crysta
stance soluble in alcohol,—no doubt a stearoptene. Before m
likewise contains starch granules and large oil-cells. This
traversed by very small vascular bundles containing annul
dotted vessels.

Chemical Composition—The most important constituent c
berries is the volatile oil, obtainable to the extent of 1 to 2
It is a mixture of two levogyre oils, the one of which having th
sition $C^{10}H^{16}$, boils at 155° C.; the other which predominates i
fruit, has the formula $C^{20}H^{32}$, and boils at 205° C. The cru
distilled by one of ourselves, deviated 3°·5 to the left in a c
50 mm.

The berries are rich in sugar (33 per cent., Trommsdorff 1
per cent. Donath, 1873), and contain also according to Don
amounts of formic, acetic and malic acids, besides resin and a
called *Juniperin*. This last, which exists in very small prop
soluble in hot water but uncrystallizable.

HERBA SABINÆ.

umina vel Summitates Sabinæ; Savin or Savine; F. Sabine; G. Sevenkraut.

ınical Origin—*Juniperus Sabina* L., a woody evergreen shrub, of small size and low-growing, spreading habit, but in some erect and arborescent.

curs in the Southern Alps of Austria and Switzerland, and in :ent mountains of France and Piedmont, ascending to elevations :o 5000 feet. It is also found in the Pyrenees, Central Spain, l the Crimea; likewise in the Caucasus, where it reaches 12,000 e the sea level. Eastward, it extends to the Elburs range south aspian, and throughout Southern Siberia. In North America, en gathered on the banks of the river Saskatchewan, at Lake nd in Newfoundland.

ory—Savin is mentioned as a veterinary drug by Marcus Cato,[1] a Roman writer on husbandry who flourished in the entury B.C.; and it was well known to Dioscorides and Pliny. t which is frequently named in the early English leech-books before the Norman Conquest,[2] may probably have been intro- to Britain by the Romans. Charlemagne ordered that it should ated on the imperial farms of Central Europe. Its virtues as ating application to wounds and ulcers are noticed in the verses r Floridus,[3] composed in the 10th century.

:ription—The medicinal part of savin is the young and tender ›ots, stripped from the more woody twigs and branches. These ıed with minute scale-like rhomboid leaves, arranged alternately te pairs. On the younger twigs, they are closely adpressed, ncave, rounded on the back, in the middle of which is a con- depressed oil gland. As the shoots grow older, the leaves nore pointed, and divergent from the stem. Savin evolves when ır bruised, a strong and not disagreeable odour. The fruit or resembling a small berry of the size of a pea, grows on a short stalk, and is covered with a blue bloom. It is globular, dry, nding in essential oil, and contains 1 to 4 little bony nuts.

nistry—The odour of savin is due to an essential oil, of which tops afford 2 to 2¾ per cent., and the berries about 10 per cent. d in a column 50 millimetres long, it was found to deviate the ray ed light 27° to the right, the oil used having been distilled by one London from the fresh plant cultivated at Mitcham. The same ıs obtained from the oil extracted ten years previously from lected wild on the Alps of the Canton de Vaud. We find that ›rolonged action of the air, if the oil is kept in a vessel not closed, the rotatory power after the lapse of years is greatly Savin oil has the same composition as oil of turpentine; we t been able to obtain from it a crystallized hydrochloride. ›s contain traces of tannic matter.

x. (*Rubus medicamentum*).
ne, *Leechdoms, &c. of Early Eng-*
565) xii.

[3] Choulant, *Macer F*[illegible] *herbarum*, Lipsiæ, 1832. 18.

Monocotyledons.

CANNACEÆ.

AMYLUM MARANTÆ.

Arrowroot.

anical Origin—*Maranta arundinacea* L.—An herbaceous ɔg plant, 4 to 6 feet high, with ovate-lanceolate, puberulous or glabrous leaves, and small white flowers, solitary or in lax . It is a native of the tropical parts of America from Mexico l, and of the West Indian Islands; and under the slightly difrm known as *M. indica* Tussac, it occurs in Bengal, Java and the nes. This Asiatic variety is now found in the West Indies and America, but apparently as an introduced plant.[1]

:ory—The history of arrowroot is comparatively recent. Passing ıe early references of French writers on the West Indies to an *.r flèches*, which plant it is impossible to identify with *Maranta*, in Sloane's catalogue of Jamaica plants (1696), *Canna Indica lba alexipharmaca.* This plant discovered in Dominica, was sent o Barbados and subsequently to Jamaica, it being, says Sloane, *ıch esteemed for its alexipharmack qualities.*" It was observed, that the native Indians used the root of the plant with success the poison of their arrows, "*by only mashing and applying it to n'd wounds*": and further, that it cures the poison of the man-*Hippomane Mancinella* L.), of the wasps of Guadaloupe, and even *begun gangreen.*"[2]

ick Browne (1756) notices the reputed alexipharmic virtues of *t*, which was then cultivated in many gardens in Jamaica, and t the root "*washed, pounded fine and bleached, makes a fine flour ch,*"—sometimes used as food when provisions are scarce.[3]

ccept the opinion of Kornicke *hio Marantearum Prodromus, 'a Soc. imp. des Naturalistes de* :xv. 1862, i.) that *Maranta arun-.* and *M. indica* Tuss. are one me species. Grisebach maintains istinct (*Flora of the British West lands*, 1864, 605), allowing both ves of Tropical America; but he oint out any important character they may be distinguished from . According to Miquel (*Linnæa* . 71) the plant in the herbarium of Linnæus labelled *M. arundinacea*, is *M. indica*. We have ourselves made arrowroot from the fresh rhizomes of *M. arundinacea*, in order to compare it with an authentic specimen obtained in Java from *M. indica*: no difference could be found between them.

[2] Sloane, *Catal. plant. quæ in ins. Jamaica sponte proveniunt, vel vulgò colunturr*, Lond. 1696. 122; also *Hist. of Jamaica*, i. (1707) 253.

[3] *Civil and Natural History of Jamaica*, 1756. 112. 113.

Hughes, when writing of Barbados in 1750, describes arrowroot very useful plant, the juice mixed with water and drunk, being reg as "*a preservative against any poison of an hot nature*"; while fro root the finest starch is made, far excelling that of wheat.[1] The perties of *Maranta arundinacea* as a counter-poison are insisted up some length by Lunan,[2] who concludes his notice of the plant by d ing the process for extracting starch from the rhizome.

Arrowroot came into use in England about the commencement present century, the supplies being obtained, as it would appear, Jamaica.[3]

The statements of Sloane, which are confirmed by Browne Lunan, plainly indicate the origin and meaning of the word *arro* and disprove the notion of the learned C. F. Ph. von Martius that the name is derived from that of the Aruac or Aroaquis In of South America, who call the finest sort of fecula they obtain the Mandioc, *Aru-aru*. It is true that *Maranta arundinacea* is k at the present day in Brazil as *Araruta*, but the name is certai corruption of the English word *arrowroot*, the plant according to ge report having been introduced.[4]

Manufacture—For the production of arrowroot, the rhizome dug up after the plant has attained its complete maturity, whi Georgia is at the beginning of winter. The scales which cover the removed and the rhizomes washed; the latter are then ground in a and the pulp is washed on sieves, or in washing machines constr for the purpose, in order to remove from it the starch. This is all to settle down in pure water, is then drained and finally dried w gentle heat. Instead of being crushed in a mill, the rhizomes are times grated to a pulp by a rasping machine.

In all stages of the process for making arrowroot, nice pre have to be taken to avoid contamination with dust, iron mould, in or anything which can impart colour or taste to the produ rhizome contains about 68 per cent. of water, and yields abou its weight of starch.[5]

Description—Arrowroot is a brilliant white, insipid, powder, more or less aggregated into lumps which seldom exce in size; when pressed, it emits a slight crackling sound. It exhi general properties of starch, consisting entirely of granules wi subspherical, or broadly and irregularly egg-shaped; when seen they show a distinct stratification in the form of fine concentri around a small star-like hilum. They have a diameter of 5 to when observed in the air or under benzol. If the water in wh lie be cautiously heated on the object-stage of the microsc tumefaction of the granules will be found to begin exactly a

[1] *Natural History of Barbados*, 1750. 221.

[2] *Hortus Jamaicensis*, i. (1814) 30.

[3] Thus in 1799, there were exported from Jamaica 24 casks and boxes of "*Indian Arrow-root*."—Renny, *Hist. of Jamaica*, 235.

[4] Since the above was written, the following lines bearing on this question have been received from Mr. Spruce:—". . I know not Martius' derivation of '*arrowroot*.' On the Amazon, it is called '*araruta*'—corruption of the English name. plained by the fact that it was vated, as I was told, from tubers the East Indies."

[5] This was in the German colony menau in Southern Brazil.—*Archiv der Pharm.* 134 (1868) 257.

ated to 100° C. with 20 parts of distilled water, arrowroot yields a nitransparent jelly of somewhat earthy taste and smell. By hydro-oric acid of sp. gr. 1·06, arrowroot is but imperfectly dissolved at ' C.

The specific gravity of all varieties of starch is affected by the water ich they retain at the ordinary temperature of the air. Arrowroot er prolonged exposure to an atmosphere of average moisture, and en kept at 100° C. till its weight was constant, was found to have lost ·3 per cent. of water. On subsequent exposure to the air, it regained former proportion of water.

Weighed in any liquid which is entirely devoid of action on starch, petroleum or benzol, the sp. gr. of arrowroot was found by one of us be 1·504; but 1·565 when the powder had been previously dried at 0° C.

Microscopic Structure of Arrowroot and of Starch in general. The granules are built up of layers,—a structure which may be ndered evident by the gradual action of chloride of calcium, chromic d, or an ammoniacal solution of cupric oxide. When one of these uids in a proper state of dilution is made to act upon starch, or ven for that purpose a liquid is chosen which does not act upon it ergetically, such as diastase, bile, pepsin, or saliva, it is easy to obtain esidue, which according to Nägeli, is no longer capable of swelling up boiling water, nor is immediately turned blue by iodine, except on the dition of sulphuric acid; but which is dissolved by ammoniacal pric oxide. These are the essential properties of cellulose; and this sidue has been regarded as such by Nägeli, while the dissolved portion s been distinguished as *Granulose* (Maschke, 1852).

Nägeli in his important monograph on starch,[1] has described the ction of saliva when digested with starch for a day, at a temperature of ° to 47° C.; he says that the residue is a skeleton, corresponding in m to the original grain but somewhat smaller, light, and very mobile water. He concludes that its interstitial spaces must have been pre-usly filled with granulose.

This experiment which has been repeated by one of us (F.), does t in our opinion warrant all the inferences that Nägeli has drawn from : it is true that many separate parts of the grain are dissolved by the liva, while others have disappeared down to a mere film, and others ain have been attacked in a very irregular manner. But we cannot ree with the statement that anything comparable to a skeleton of the ain has been left. After longer action at a higher temperature, which wever must not exceed 65° C., a more copious dissolution of the rch either by saliva or by bile, takes place; but in no case is it nplete.[2]

Chemistry of Starch—The formula, $C^{6}H^{10}O^{5}$, is commonly assigned starch, from whatever plant derived. Musculus however showed in 51, that by the action of dilute acids or of *Diastase*, starch is resolved o *Dextrine*, $C^{12}H^{20}O^{10}$, and *Dextrose*, $C^{6}H^{12}O^{6}$, with which decomposi-n, the formula, $C^{18}H^{30}O^{15}$, would be more in accord.

Cold water is not without action on starch: if the latter be con-

Die Stärkekörner, Zürich, 1858, 4°.

Further particulars on this question may ound in my paper *Ueber Stärke und Cellulose*. *Archiv der Pharmacie*, 196 (1871) 7. - F. A. F.

ortations of arrowroot into the United Kingdom during the amounted to 21,770 cwt., value £33,063. Of this quantity, f St. Vincent in the West Indies furnished nearly 17,000 cwt., ny of Natal about 3000 cwt. The manufacture of arrowroot : India Islands appears to be on the decline, and the Ber- rticular, now ship but an insignificant quantity.[1]

Arrowroot boiled with water or milk is a much-valued food room. It is also an agreeable article of diet in the form of blancmange.

ation—Other starches than that of *Maranta* are occasionally he name of *Arrowroot*. Their recognition is only possible by he microscope.

Substitutes for Arrowroot.

Starch—This substance known in trade as *Farina* or *r* is made from the tubers of the potato (*Solanum tuberosum* cess analogous to that followed in the preparation of arrow- s the following characters :—examined under the microscope, s are seen to be chiefly of two sorts, the first small and he second of much larger size, often 100 mkm. in length, rregularly circular, oval or egg-shaped outline, finely marked ntric rings round a minute inconspicuous hilum. When vater, the grains swell considerably even at 60° C. Hydro- l, sp. gr. 1·06, dissolves them at 40° C. quickly and almost the granules being no longer deposited, as in the case of imilarly treated. The mixture of arrowroot and hydrochloric lorous, but that of potato starch has a peculiar though not our.

Starch, Tous-les-Mois,[2] ***Toulema, Tolomane*** – A species s cultivated in the West India Islands, especially St. Kitts, of a peculiar starch which, since about the year 1836, has ted from its rhizomes by a process similar to that adopted in owroot. The specific name of the plant is still undetermined : have obtained living roots from St. Kitts, and have cultivated r several years, it has not hitherto flowered, and the foliage characters sufficient for distinguishing the species.

rch, which bears the same name as the plant, is a dull white ving a peculiar satiny or lustrous aspect, by reason of the ry magnitude of the starch granules of which it is composed. ules examined under the microscope, are seen to be flattened gular form, as circular, oval, oblong, or oval-truncate. The the numerous concentric rings with which each granule is usually at one end rather than in the centre of a granule. The conspicuous. The granules though far larger than those of

ar 1868, only 60 cwt., in 1869,

monly stated that the name was given in consequence of ering *all the year round*. But ion appears improbable : no mentioned by Rochefort, Aublet, or Descourtilz, who all describe the *Balisier* or *Canna*. It seems more likely that the term is the result of an attempt to confer a meaning on an ancient name — perhaps *Touloula*, which is one of the Carib designations for *Canna* and *Calathea*.

the potato, are of the same density as the smaller forms of that sta and like them, float perfectly on chloroform. When heated, they b to burst at 72° C. Dilute hydrochloric acid acts upon them as it on arrowroot.

Canna starch boiled with 20 times its weight of water, affords a less clear and more tenacious than that of arrowroot, yet applicabl exactly the same purposes. The starch is produced on a very s scale, and is but little known and not much esteemed in Europe.[1]

Curcuma Starch, Tikor, Tikhar.—The pendulous, colourless tu of some species of *Curcuma*, but especially of *C. angustifolia* Roxb. *C. leucorrhiza* Roxb., have long been utilized in Southern India for preparation of a sort of arrowroot, known by the Hindustani nam *Tikhar*, and sometimes called by Europeans, *East Indian Arrow* The granules of this substance much resemble those of *Maranta*, they are neither spherical nor egg-shaped. On the contrary, they rather to be described as flat discs, 5 to 7 mkm. thick, of elliptic or o outline, sometimes truncate; many attain a length of 60 to 70 n They are always beautifully stratified both on the face and on the e The hilum is generally situated at the narrower end. We have obse that when heated in water, the tumefaction of the grains commenc 72° C.

Curcuma starch, which in its general properties agrees with com arrowroot, is rather extensively manufactured in Travancore, Cochin Canara on the south-western coast of India, but in a very rude ma Drury[3] states that it is a favourite article of diet among the natives, that it is exported from Travancore and Madras; we can add that not known as a special kind in the English market, and that the ar we have seen offered in the London drug sales as *East Indian Arro* was the starch of *Maranta*.

ZINGIBERACEÆ.

RHIZOMA ZINGIBERIS.

Radix Zingiberis; Ginger; F. *Gingembre;* G. *Ingwer*

Botanical Origin—*Zingiber officinale* Roscoe (*Amomum Zing* a reed-like plant, with annual leafy stems, 3 to 4 feet high, and fl in cone-shaped spikes borne on other stems thrown up from the rh It is a native of Asia, in the warmer countries of which it is univ cultivated,[4] but not known in a wild state. It has been introduc most tropical countries, and is now found in the West Indies, S America, Tropical Western Africa, and Queensland in Australia.

History—Ginger has been known in India from the remotes under the old Sanskrit name of *Sringavéra*, from which has been de the Greek name Ζιγγιβερι and the Latin *Zingiber*. As a spice

[1] 20 barrels from St. Kitts were offered in public sale in London, 10 May, 1871, and bought in at 2½*d.* per lb.

[2] Living roots of the plant used for making this arrowroot at Cochin, have been kindly forwarded to us by A. F. Scaly, Esq. place.

[3] *Useful Plants of India*, ed. 2. 1873

[4] The mode of cultivation is desc Buchanan, *Journey from Madr Mysore, etc.* ii. (1807) 469.

ed among the Greeks and Romans, who appear to have received it · way of the Red Sea, inasmuch as they considered it to be a pro-ıction of Southern Arabia.

In the list of imports from the Red Sea into Alexandria, which in e second century of our era were there liable to the Roman fiscal ıty (*vectigal*), *Zingiber* occurs among other Indian spices.[1] During the iddle ages it is frequently mentioned in similiar lists, and evidently nstituted an important item in the commercial relations between ırope and the East. Ginger thus appears in the tariff of duties levied Acre in Palestine about A.D. 1173;[2] in that of Barcelona[3] in :21; Marseilles[4] in 1228; and Paris[5] in 1296. The *Tarif des Péages*, customs tariff, of the Counts of Provence in the middle of the 13th ntury, provides for the levying of duty at the towns of Aix, Digne, alensole, Tarascon, Avignon, Orgon, Arles, &c., on various commodities ıported from the East. These included spices, as pepper, *ginger*, ıves, zedoary, galangal, cubebs, saffron, "canella," cumin, anise; dye affs, such as lac, indigo, Brazil wood, and especially alum; and groceries, sugar, rice and dates.[6]

In England, ginger must have been tolerably well known even ior to the Norman Conquest, for it is frequently named in the Anglo-.xon leech-books of the 11th century. During the 13th and 14th nturies, it was next to pepper, the commonest of spices, costing on . average nearly 1*s.* 7*d.* per ℔., or about the price of a sheep.[7]

The merchants of Italy about the middle of the 14th century, knew ree kinds of ginger, called respectively *Belledi*, *Colombino*, and *Micchino*. ıese terms may be explained thus:—*Belledi* or *Baladi* is an Arabic ɔrd, which as applied to ginger, would signify *country* or *wild*, i.e. *ɔmon ginger*. *Colombino* refers to Columbum, Kolam or Quilon, a ɔrt in Travancore frequently mentioned in the middle ages. Ginger rmed *Micchino*, denotes that the spice had been brought from or by ay of Mecca.[8]

Ginger preserved in syrup, and sometimes called *Green Ginger*, was so imported during the middle ages, and regarded as a delicacy of e choicest kind.

The plant affording ginger must have been known to Marco Polo ·rca 1280–90), who speaks of observing it both in China and India. ·hn of Montecorvino, who visited India about 1292 (see p. 468), scribes ginger as a plant like a flag, the root of which can be dug ı and transported. Nicolo Conti in the beginning of the 15th century so gave some description of the plant and of the collection of the root, witnessed by him in India.[9]

The Venetians received ginger by way of Egypt; yet some of the perior kinds were conveyed from India overland by the Black Sea, stated by Marino Sanudo[10] about 1306.

Vincent, *Commerce and Navigation of Ancients*, ii. (1807) 695.

Recueil des Historiens des Croisades; Lois, 1843) 176.

Capmany, *Memorias sobre la Marina, de Barcelona*, Madrid, ii. (1779) 3.

Méry et Guindon, *Hist. des Actes . . . . Municipalité de Marseille*, i. (1841) 372.

Revue archéologique, ix. (1852) 213.

[6] *Collection de Cartulaires de France*, Paris, viii. (1857) pp. lxxiii xci.

[7] Rogers, *Hist. of Agriculture and Prices in England*, i. (1866) 629.

[8] Yule, *Book of Ser Marco Polo*, ii. (1871) 316.

[9] See p. 469, note 3.

[10] Marinus Sanutus, *Liber secretorum fidelium crucis*, Hanov. (1611) 22.

Ginger was introduced into America by Francisco de Me who took it from the East Indies to New Spain.[1] It was shipp commercial purposes from the island of St. Domingo as early at k 1585; and from Barbados in 1654.[2] According to Renny, very quantities were exported from the West Indies to Spain in 1547.[3]

Description—Ginger is known in two forms, namely the ri dried with its epidermis, in which case it is called *coated;* or de of epidermis, and then termed *scraped* or *uncoated.* The pieces, are called by the spice-dealers *races* or *hands,* rarely exceed 4 inc length and have a somewhat palmate form, being made up of a of short, laterally compressed, lobe-like shoots or knobs, the sum each of which is marked by a depression indicating the former a ment of the leafy stem.

To produce the *uncoated ginger,* which is that preferred for me use, the fresh rhizome is scraped, washed, and then dried in the su

Thus prepared, it has a pale buff hue, and a striated, som fibrous surface. It breaks easily, exhibiting a short and farin fracture with numerous bristle-like fibres. When cut with a kni younger or terminal portion of the rhizome appears pale yellow, so amylaceous, while the older part is flinty, hard and resinous.

Coated ginger, or that which has been dried without the remo the epidermis, is covered with a wrinkled, striated, brown integu which imparts to it a somewhat coarse and crude appearance. nally, it is usually of a less bright and delicate hue than ginger which the cortical part has been removed. Much of it indeed, is horny and resinous.

Ginger has an agreeable aromatic odour with a strong pungent

Varieties—Those at present found in the London market, are guished as *Jamaica, Cochin, Bengal,* and *African.* The first two *scraped* gingers; the last named is a *coated* ginger, that is to say, retains its epidermis. Jamaica Ginger is the sort most esteemed next to it, the Cochin. But of each kind there are several presenting considerable variation *inter se.*

Scraped or decorticated ginger is often bleached, either by subjected to the fumes of burning sulphur, or by immersion for a time in solution of chlorinated lime. Much of that seen in the shops looks as if it had been whitewashed, and in fact is slightly with calcareous matter,—either sulphate or carbonate of calcium.

Microscopic Structure—A transverse section of coated exhibits a brown, horny external layer, about one millimetre separated by a fine line from the whitish mealy interior portion, the tissue of which numerous vascular bundles and resinous irregularly scattered. The external tissue consists of a loose outer and an inner composed of tabular cells: these are followed by p short prosenchymatous cells, the walls of which are sinuous on trans

[1] Monardes, *Historia de las cosas que se traen de nuestras Indias occidentales,* Sevilla, (1574) 99.

[2] *Calendar of State Papers, Colonial Series,* 1574-1660. Lond. 1860 p. 4; see also pp. 414, 434.

[3] 22,053 cwt. See Renny, *Hist. maica,* Lond. 1807, 154.

[4] Mr. Garside (*Pharm. Journ.* A 1874) found both. We have the carbonate to be used.

ion and partially thickened, imparting a horny appearance. This :ate felted tissue forms the striated surface of *scraped ginger*, and is principal seat of the resin and volatile oil, which here fill large es. The large-celled parenchyme which succeeds, is loaded with :h, and likewise contains numerous masses of resin and drops of The starch granules are irregularly spherical, attaining at the utmost nkm. Certain varieties of ginger, owing to the starch having been lered gelatinous by scalding, are throughout horny and translucent. circle of vascular bundles which separates the outer layers and the ral portion, is narrow, and has the structure of the corresponding e or nucleus sheath in turmeric.

Chemical Composition—Ginger contains a volatile oil which is only constituent of the drug that has hitherto been investigated. By lling 112 lb. of Jamaica ginger with water in the usual way, we ined 4½ ounces of this oil, or about ¼ per cent. It is a pale yellow id of sp. gr. 0·878, having the peculiar odour of ginger, but not its gent taste. It has no acid reaction; dissolves but sparingly in t of wine (0·83); and deviates the ray of polarized light 21°6 to left, when examined in a column 50 mm. long.

The burning taste of ginger is due to a resin which we have not nined, but which well deserves careful analysis.

Commerce—Great Britain imported of ginger as follows :—

1868	1869	1870	1871	1872
52,194 cwt.	34,535 cwt.	33,854 cwt.	32,723 cwt.	32,174 cwt.

drug was received in 1872 thus :—

From Egypt	4,923 cwt.
,, Sierra Leone	6,167 ,,
,, British India	13,310 ,,
,, British West Indies	7,543 ,,
,, other countries	231 ,,
Total	32,174 ,,

The importations of ginger from the West Indies have of late years :h declined.

Uses—Ginger is an agreeable aromatic and stomachic, and as such ten a valuable addition to other medicines. It is much more largely loyed as a condiment than as a drug.

RHIZOMA CURCUMÆ.

Lat. Curcumæ;[1] *Turmeric;* F. *Curcuma;* G. *Gelbwurzel, Kurkuma.*

Botanical Origin—*Curcuma longa* L.—Turmeric is indigenous to thern Asia and is there largely cultivated both on the continent and he islands.

History—Dioscorides mentions an Indian plant as a kind of *Cyperus* reipes) resembling ginger, but having when chewed, a yellow colour bitter taste: probably turmeric was intended. Garcia d'Orta (1563), ell as Fragoso (1572), describe turmeric as *Crocus indicus*. A list of

[1] *Curcuma* from the Persian *kurkum*, a name applied also to saffron. The origin of ord *Turmeric* is not known to us.

drugs sold in the city of Frankfort about the year 1450, names *Cu* along with zedoary and ginger.[1]

In its native countries, it has from remote times been highly est both as a condiment and a dye-stuff; in Europe, it has always less appreciated than the allied spices of the ginger tribe. inventory of the effects of a Yorkshire tradesman, dated 20 Sept. we find enumerated—"*x. owncis of turmeracke, x d.*"[2]

Description—The base of the scape thickens in the first ye an ovate root-stock; this afterwards throws out shoots, forming lat secondary rhizomes, each emitting roots, which branch into fibres sometimes enlarged as colourless spindle-shaped tubers, rich in The lateral rhizomes are doubtless in a condition to develope them as independent plants when separated from the parent. The c rhizomes formerly known as *Curcuma rotunda*, and the elongated ones as *Curcuma longa*, were regarded by Linnæus as the product distinct species.

The radical tubers of some species of *Curcuma* as *C. angus* Roxb., are used for making a sort of arrowroot (p. 574). Sometime are dried, and constitute the peculiar kind of turmeric which the C call *Yuh-kin*.[3]

The turmeric of commerce consists of the two sorts of rhizom mentioned, namely, the *central* or *round* and the *lateral* or *long*. former are ovate, pyriform or subspherical, sometimes pointed a upper end and crowned with the remains of leaves, while the sid beset with those of roots and marked with concentric ridges. Th meter is very variable, but is seldom less than ¾ of an inch, a frequently much more. They are often cut and usually scalded in to destroy their vitality and facilitate drying.

The lateral rhizomes are subcylindrical, attenuated towards e end, generally curved, covered with a rugose skin, and marked less plainly with transverse rings. Sometimes one, two or more knobs or shoots, grow out on one side. The rhizomes, whether rou long, are very hard and firm, exhibiting when broken a dull, resinous surface, of an orange or orange-brown hue, more or brilliant. They have a peculiar aromatic odour and taste.

Several varieties of turmeric distinguished by the names of countries or districts in which they are produced, are found in English market: but although they present differences whi sufficiently appreciable to the eye of the experienced dealer characters of each sort are scarcely so marked or so constant as recognizable by mere verbal description. The principal sorts commerce are known as *China*, *Madras*, *Bengal*, *Java*, and these the first named is the most esteemed, but it is seldom to with in the European market.[4]

Madras Turmeric is a fine sort in large, bold pieces. Sometimes packages of it contain exclusively round rhizomes, while others made up entirely of the long or lateral.

[1] Flückiger, *Die Frankfurter Liste*, Halle, 1873. 11.

[2] Raine, *Wills and Inventories of the Archdeaconry of Richmond* (Surtees Society), 1853. 277.

[3] *Pharm. Journ.* iii. (1862) 260, fig. 11.—It is not wholly devoid of yellow matter.

[4] A good deal is exported from Formosa, but mostly to Chine *Returns of Trade at the Treaty Ports for* 1872. p. 106.

Bengal Turmeric differs from the other varieties chiefly in its deeper nt, and hence is the sort preferred for dyeing purposes.

Java Turmeric presents no very distinctive features; it is dusted ith its own powder, and does not show when broken a very brilliant lour. Judging by the low price at which it is quoted, it is not in great teem. It is the produce of *Curcuma longa* var. *β minor*[1] Hassk.

Microscopic Structure—The suberous coat is made up of 8 to 10 ws of tabular cells; the parenchyme of the middle cortical layer, of rge roundish polyhedral cells. Towards the centre, the transverse ction exhibits a coherent ring of fibro-vascular bundles, representing a nd of medullary sheath. The parenchyme enclosed by this ring is aversed by scattered bundles of vessels, and in most of its cells ntains starch in amorphous, angular or roundish masses, which are so r disorganized that they no longer exhibit the usual appearance in larized light, but are nevertheless turned blue by iodine. The starch s been reduced to this condition by scalding.

Resin likewise occurs in separate cells, forming dark yellowish-red rticles. The entire tissue is penetrated with yellow colouring matter, d shows numerous drops of essential oil, which in the fresh rhizome no doubt contained in peculiar cells.

Chemical Composition—The drug yields about one per cent. of sential oil which, according to Suida and Daube (1868), consists of an l homologous or isomeric with carvol and thymol, $C^{10}H^{14}O$, combined ith a small proportion of a hydrocarbon.

The colouring matter called *Curcumin* is obtained by exhausting the ug with benzol, after the essential oil has been distilled off. The ude crystals obtained from benzol are dissolved in spirit of wine, and ecipitated with basic acetate of lead. The latter is then removed by lphuretted hydrogen, and the curcumin re-crystallized from spirit of ne. It then forms yellow crystals, having an odour of vanilla, and hibiting a fine blue in reflected light. Daube[2] assigns them the formula, $C^{10}H^{10}O^{13}$. The best produce of curcumin is stated by Ivanowjewsky[3] to be obtained by washing an ethereal extract of turmeric h weak ammonia, dissolving the residue in boiling concentrated monia, and passing into the solution carbonic acid, by which the cumin is precipitated in flakes.

Paper tinged with an alcoholic solution of curcumin displays on ition of an alkali a brownish-red coloration, becoming violet on ing. Boracic acid produces an orange tint, turning blue by addition an alkaline solution.[4] This behaviour of (impure) curcumin was ted out by Vogel as early as 1815, and has since that time been ized as a chemical test.

Borax added to an alcoholic solution of curcumin, gives rise to a substance, the *Rosocyanin* of Schlumberger (1866), which Daube

rom information communicated by Mr. ndyk, of the Botanical Garden, Buiten-Java.

urn. *fur prakt. Chemie*, ii. (1871) 86.

urn. *of Chem. Soc.* xi. (1873) 504.

he following is a striking experiment, g some of these changes of colour:—a little crushed turmeric or the powder tting paper, and moisten it repeatedly with chloroform, allowing the latter to evaporate. There will thus be formed on the paper a yellow stain which on addition of a slightly acidulated solution of borax and drying assumes a purple hue. If the paper is now sprinkled with dilute ammonia, it will acquire a transient blue. This reaction enables one to recognize the presence of turmeric in powdered rhubarb or mustard.

also obtained, and in crystals. Ivanow-Gajewsky, who isolated heating an alcoholic extract of turmeric with boracic and su acids, describes it as a purple crystalline powder with a metalli lustre, insoluble in water but soluble in alcohol. Its solution is c dark blue by an alkali.

According to the same chemist, there also exists in curcu alkaloid in very small quantity.[1] Kachler[2] found in the a decoction an abundance of *Bioxalate of Potassium.*

Commerce—In the year 1869, there were imported into the Kingdom, 64,280 cwt. of turmeric; in 1870, 44,900 cwt.,—a ver proportion being furnished by Bengal and Pegu. The expor Calcutta[3] in the year 1870–71, was 59,352 cwt.

Bombay exported in the year 1871–72, 29,780 cwt., of whi greater portion was shipped to Sind and the Persian Gulf, and on cwt. to Europe.[4]

Uses—Turmeric is employed as a condiment in the shape of powder, and as such is often sold by druggists; but as a medicin obsolete. It is largely consumed in dyeing.

Substitute—The London market has lately been supplied considerable quantities of a drug called *Cochin Turmeric,* which produce of some other species of *Curcuma* than *C. longa.* It co exclusively of a bulb-shaped rhizome of large dimensions, cut versely or longitudinally into slices or segments. The cortical p dull brown; the inner substance is horny and of a deep orange-b or when in thin shavings, of a brilliant yellow. Mr. A. Forbes Se Cochin has been good enough to send us (1873) living rhizomes of *Curcuma,* which he states is mostly grown at Alwaye, north-ea Cochin, and is never used in the country as *turmeric,* though its st tubers are employed for making arrowroot. The rhizomes sent are t short, conical and of enormous size, some attaining as much as 2½ in in diameter. Internally they are of a bright orange-yellow.

RHIZOMA GALANGÆ.

Radix Galangæ[5] *minoris; Galangal;* F. *Racine de Galanga;* G. *Ga*

Botanical Origin—*Alpinia officinarum* Hance,[6] a flag-like p with stems about 4 feet high, clothed with narrow lanceolate le and terminating in short and simple racemes of elegant white flo shaded and veined with dull red. It grows cultivated in the isla Hainan in the south of China, and, as is supposed, in some of southern provinces of the Chinese Empire.

[1] *Berichte der Deutschen Chem. Gesellsch.* iii. (1870) 624.

[2] Ibid. 713.

[3] Returns quoted at p. 514, note 3.

[4] *Statement of the Trade and Navigation of Bombay for* 1871–72, pt. ii. 95.

[5] *Galanga* appears to be derived from the Arabic name *Khulanjan,* which in turn comes from the Chinese *Kau-liang Kiang,* signifying, as Dr. F. Porter Smith has informed us, *Kau-liang ginger.* Kau-li the ancient name of a district in the p of Kwangtung.

[6] *Journ. of Linnean Society,* Bota (1873) 1; also Trimen's *Journ.* (1873) 175.—Dr. Thwaites of Ceylon has the plant in cultivation, has been enough to send us a fine coloured dra of it in flower.

istory—The earliest reference to galangal we have met with, in the writings of the Arabian geographer Ibn Khurdádbah [1] about 39–885, who in enumerating the productions of a country called names galangal together with musk, aloes, camphor, silk, and Edrisi,[2] three hundred years later is more explicit, for he men- t with many other productions of the far East, as brought from and China to Aden, then a great emporium of the trade of Asia Egypt and Europe. The physician Alkindi,[3] who lived at Bassora Bagdad in the second half of the 9th century, and somewhat later s and Avicenna, notice galangal, the use of which was introduced Europe through the medical system promulgated by them and other s of the same school.

any notices exist showing that galangal was imported with pepper, , cloves, nutmegs, cardamoms and zedoary; and that during the e ages it was used in common with these substances as a culinary which it is still held to be in certain parts of Europe.[4] The affording the drug was unknown until the year 1870, when a ption of it was communicated to the Linnean Society of London, H. F. Hance, from specimens collected by Mr. E. C. Taintor, near w in the north of Hainan.

escription—The drug consists of a cylindrical rhizome, having imum diameter of about $\frac{3}{4}$ of an inch, but for the most part erably smaller. This rhizome has been cut while fresh into short , $1\frac{1}{2}$ to 3 inches in length, which are often branched, and are d transversely at short intervals by narrow raised sinuous rings, ting the former attachment of leaves or scales. The pieces are tough and shrivelled, externally of a dark reddish-brown, display- hen cut transversely, an internal substance of rather paler hue never white), with a darker central column. The drug exhales comminuted an agreeable aroma, and has a strongly pungent, taste.

icroscopic Structure—The central portion of the rhizome is ted from the outer tissue by the nucleus sheath, which appears as -defined darker line. Yet the central tissue does not differ much hat surrounding it, both being composed of uniform parenchyme traversed by scattered vascular bundles. There also occur through- e whole tissue, isolated cells loaded with essential oil or resin. e larger number of cells abound in large starch granules of an al club-shaped form. Some cells contain a brown substance, dif- from resin in being insoluble in alcohol. The corky layer is kable from its cells having undulated walls.

emical Composition—The odour of galangal is due to an ial oil, which the rhizoma yields to the extent of only $\frac{1}{3}$ to $\frac{1}{2}$ per and which appears from the experiments of Vogel, to have the sition, $C^{10}H^{16}H^{2}O$. Brandes [5] extracted from galangal by means

rk quoted at p. 251, note 5.—tome

graphie d'Edrisi, traduite par Jau- 1836) 51.

Rerum gradibus, Argentorati, 1531.

[4] Hanbury, *Historical Notes on the Radix Galangæ of pharmacy—Journ. of Linnean Society*, Bot. xiii. (1873) 20; *Pharm. Journ.* Sept. 23, 1871. 248.

[5] *Archiv der Pharm.* xix. (1839) 52.

of ether, a neutral inodorous and tasteless crystalline body called *Kämpferid*, which is worthy of further examination.

The pungent principle of the drug, which is probably analogous to that of ginger, has not been studied.

Commerce—Galangal is shipped from Canton to other ports of China, to India and Europe, but there are no general statistics to give an idea of the total production. From official returns quoted by Hance, the export in the year 1869, which seems to have been exceptionally large, amounted to 370,800 ℔. Bombay in the year 1870–71, imported the drug to the extent of 335 cwt.[1]

Uses—The drug is an aromatic stimulant of the nature of ginger, now nearly obsolete in British medicine. It is still a popular remedy and spice in Livonia, Esthonia and Central Russia, and by the Tartars is taken with tea. It is also in some requisition in Russia among brewers, and the manufacturers of vinegar and cordials, and finally as a cattle medicine.

Substitute—The rhizoma of *Alpinia Galanga* Willd., a plant of Java, constitutes the drug known as *Radix Galangæ majoris* or *Greater Galangal*, packages of which occasionally appear in the London drug sales. It may be at once distinguished from the Chinese drug by its much larger size and the pale buff hue of its internal substance, the latter in strong contrast with the orange-brown outer skin.

FRUCTUS CARDAMOMI.

Semina Cardamomi minoris; Cardamoms, Malabar Cardamoms; F. *Cardamomes;* G. *Cardamomen.*

Botanical Origin—*Elettaria*[2] *Cardamomum* Maton (*Alpinia Cardamomum* Roxb.), a flag-like perennial plant, 6 to 12 feet high, with large lanceolate leaves on long sheathing stalks, and flowers in lax flexuose horizontal scapes, 6 to 18 inches in length, which are thrown out to the number of 3 or 4, close to the ground. The fruit is ovoid, three-sided, plump and smooth, with a fleshy green pericarp.

The cardamom plant grows abundantly, both wild and under cultivation, in the moist shady mountain forests of North Canara, Coorg and Wynaad on the Malabar Coast, at an elevation of 2500 to 5000 feet above the sea. It is truly wild in Canara and in the Anamalai, Cochin and Travancore forests. The cardamom region has a mean temperature of 22° C. (72° F.), and a mean rainfall of 121 inches.

A well-marked variety, differing chiefly in the elongated form and large size of its fruits, is found wild in the forests of the central and southern provinces of Ceylon. It was formerly regarded as a distinct species under the name of *Elettaria major*, but careful observation of growing specimens has shown that it possesses no characters to warrant it being considered more than a variety of the typical plant, and it is therefore now called *E. Cardamomum* var. *β*. It is only known to occur

[1] Returns quoted at p. 366, note 3.

[2] From *Elettari*, the Malyalim name of the plant.

, where the ordinary Cardamom of Malabar is not found except
:ated plant.[1]

ry—The Malabar cardamom is mentioned in the writings of
nd hence may have been used in India from a remote period.
unlikely that in common with ginger and pepper it reached
classical times, although it is not possible from the descriptions
come down, to determine exactly what was the Καρδάμωμον
rastus and Dioscorides, or the Ἄμωμον of the last-named writer.
num, *Amomis* and *Cardamomum* of Pliny are also doubtful, the
n he gives of the last being unintelligible as applied to anything
n by that name.

list of Indian spices liable to duty at the Roman custom house
idria, *circa* A.D. 176–180, *Amomum* as well as *Cardamomum* is
.[2] St. Jerome names *Amomum* together with musk, as per-
ise among the voluptuous ecclesiastics of the 4th century.[3]
noms are named by Edrisi[4] about A.D. 1154 as a production of
id also as an article of trade from China to Aden; and in the
ury they are mentioned together with cinnamon and cloves
an import into Palestine by way of Acre, then a trading city
:ant.

st writer who definitely and correctly states the country of the
, appears to be the Portuguese navigator Barbosa[5] (1514) who
names it as a production of the Malabar Coast. Garcia d'Orta,[6]
to the Viceroy at Goa about 1563, mentions the shipment of
o Europe; he also ascertained that the larger sort was produced
The Malabar cardamom plant was figured by Rheede under
ous name of *Elettari*.[7]

ation and Production—Although the cardamom plant grows
e forests of Southern India, where it is commonly called *Iláchi*,
ire largely obtained from cultivated plants. The methods of
, which vary in the different districts, may be thus described:—
vious to the commencement of the rains, the cultivators ascend
ain sides, and seek in the shady evergreen forests a spot where
amom plants are growing. Here they make small clearings, in
admission of light occasions the plant to develope in abundance.
mom plants attain 2 to 3 feet in height during the following
after which the ground is again cleared of weeds, protected
ce, and left to itself for a year. About two years after the
ng, the plants begin to flower, and five months later ripen
s, but a full crop is not got till at least a year after. The
tinue productive six or seven years. A garden, 484 square
area, four of which may be made in an acre of forest,
on an average, an annual crop of 12½ ℔. of garbled
s.[8] Ludlow, an Assistant Conservator of Forests, reckons

, *Enumeratio Plantarum Zey-*
318.
'eschichte d. Botanik, ii. (1855)
t, *Commerce of the Ancients*, ii.
ymi Opera Omnia, ed. Migne,
.
ie d'Edrisi, traduite par Jaubert, i. (1836) 73, 51.—It is questionable whether *Elettaria* is intended at p. 51.
[5] *Description of the Coasts of East Africa and Malabar*, Hakluyt Society, 1866. 59. 64, 147. 154. &c.
[6] In the work quoted at p. 492, note 7.
[7] *Hortus Malabaricus*, xi. (1692) tab. 4–5.
[8] *Report on the Administration of Coorg for the year* 1872–73, Bangalore, 1873. 44.

that not more than 28 lb. can be got from an acre of forest. From what he says, it further appears that the plants which come up on clearings of the Coorg forests are mainly *seedlings*, which make their appearance in the same *quasi*-spontaneous manner as certain plants in the clearings of a wood in Europe. He says they commence to bear in about 3½ years after their first appearance.[1] The plan of cultivation above described is that pursued in the forests of Travancore, Coorg and Wynaad.

2. On the lower range of the Pulney Hills, near Dindigul, at an elevation of about 5000 feet above the sea, the cardamom plant is cultivated in the shade. The natives burn down the underwood, and clear away the small trees of the dense moist forests called *sholas*, which are damp all the year round. The cardamoms are then sown, and when a few inches high, are planted out, either singly or in twos, under the shade of the large trees. They take five years before they bear fruit; "in October" remarks our informant,[2] "I saw the plants in full flower and also in fruit,—the latter not however ripe."

3. In North Canara and Western Mysore, the cardamom is cultivated in the betel-nut plantations. The plants, which are raised from seed, are planted between the palms, from which and from plantains, they derive a certain amount of shade. They are said to produce fruit in their third year.

Cardamoms begin to ripen in October, and the gathering continues during dry weather for two or three months. All the fruits on a scape do not become ripe at the same time, yet too generally the whole scape is gathered at once and dried,—to the manifest detriment of the drug. This is done partly to save the fruit from being eaten by snakes, frogs and squirrels, and partly to avoid the capsules splitting, which they do when quite mature. In some plantations however, the cardamoms are gathered in a more reasonable fashion. As they are collected, the fruits are carried to the houses, laid out for a few days on mats, then stripped from their scapes, and the drying completed by a gentle fire-heat. In Coorg the fruit is stripped from the scape before drying, and the drying is sometimes effected wholly by sun-heat.

In the native states of Cochin and Travancore, cardamoms are a monopoly of the respective governments. The rajah of the latter state requires that all the produce shall be sold to his officials, who forward it to the main depôt at Alapalli or Aleppy, a port in Travancore, where his commercial agent resides. The rajah is tenacious of his rights, and inserts a clause in the leases he grants to European coffee-planters, of whom a great many have settled in his territory, requiring that cardamoms shall not be grown.

The cardamoms at Aleppy are sold by auction, and bought chiefly by Moplah merchants for transport to different parts of India, and also, through third parties, to England. All the lower qualities are consumed in India, and the finer alone shipped to Europe.

In the forests belonging to the British Government, cardamoms are

[1] Elliot, *Experiences of a Planter in the Jungles of Mysore*, Lond. ii. (1871) 201. 209.

[2] Colonel Beddome, Conservator of Forests, Madras. We have likewise to acknowledge information on this head from Dr. Brandis, Inspector-General of Forests in India, and Dr. King, Director of the Botanic Garden, Calcutta.

oned among the miscellaneous items of produce; but
e cardamom forests are now let at a rental of £3000 per
r a lease which will expire in 1878.[1]

horn, late Conservator of Forests in the Madras Presidency,
a letter to one of us, that the rapid extension of coffee
the slopes of the Malabar mountains has tended to lessen
on of cardamoms, and has encroached considerably upon the
indigenous growth. A recent writer[2] has shown from his
nce, that the cultivation of the cardamom is a branch of
th the attention of Europeans, and has given many valuable
suring successful results.

tion—The fruit of the Malabar cardamom as found in com-
ovoid or oblong, three-sided, three-valved capsule, contain-
s seeds arranged in three cells. It is rounded at the base, and
a small stalk; towards the apex it is more or less contracted
es in a short beak. The longitudinally-striated, inodorous,
icarp is of a pale greyish-yellow, or buff, or brown when
a thin papery consistence, splitting lengthwise into three
m the middle of the inner side of each valve, a thin par-
ts towards the axis, thereby producing three cells, each of
es 5 to 7 dark brown, aromatic seeds, arranged in two rows
in the central angle.

ls, which are about 2 lines long, are irregularly angular,
rugose, and have a depressed hilum and a deeply channelled
h seed is enclosed in a thin colourless aril.

ms vary in size, shape, colour and flavour: those which are
d or nearly globular, and $\frac{4}{10}$ to $\frac{6}{10}$ of an inch in length, are
rade language *shorts;* while those of a more elongated form,
each end, and $\frac{7}{10}$ to $\frac{9}{10}$ of an inch long, are called *short-*
are further distinguished by the names of localities, as
dras, and *Aleppy*. The *Malabar Cardamoms*, which are the
ed, are of full colour, and occur of both forms, namely *shorts*
gs; they are brought to Europe *viâ* Bombay. The *Madras*
f elongated form (*short-longs*) and of a more pallid hue; they
at Madras and Pondicherry. Those termed *Aleppy* are
orts, plump, beaked and of a peculiar greenish tint; they are
m Calicut, and sometimes from Aleppy.

ms are esteemed in proportion to their plumpness and
d the sound and mature condition of the seeds they contain.
s afford about three-fourths of their weight of seeds.[3]

s of the second form (var. β) of *Elettaria Cardamomum*,
ade as *Ceylon Cardamoms*, are from 1 to 2 inches in length,
of an inch in breadth, distinctly three-sided, often arched,
of a dark greyish-brown. The seeds are larger and more
an those of the Malabar plant and somewhat different in
aste.

opic Structure—The testa of the seed consists of three
rs, namely an exterior of thick-walled, spirally-striated cells,

ted at p. 583, note 8.
it., chap. 12.
lb. shelled at various times
s, afforded 154½ lb. of seeds.

(Information from the laboratory accounts of Messrs. Allen and Hanburys, Plough Court, Lombard St.)

somewhat longitudinally extended, and exhibiting on transverse square, not very large, cavities; then a row of large cells wi transverse walls; and finally, an internal layer of deep brown, r arranged cells, the walls of which have so thick a deposit that most only small cavities remain.

The granular, colourless, sac-shaped albumen encloses a horn sperm, in which the embryo is inserted, the projecting radicl directed towards the hilum. The cells of the albumen have th of elongated polyhedra, almost entirely filled with very small granules. Besides them, there occur in most of the cells, so larger masses of albuminoid matter having a rhombohedric fo tinctly observable when thin slices of the seed are examined almond oil in polarized light. These remarkable crystalloid resemble those occurring in the seeds of cumin (p. 296).

Chemical Composition — The parenchyme of the album embryo is loaded with fatty oil and essential oil, the former exis the seed to the extent of about 10 per cent.

The essential oil, which amounts on an average to 4·6 per has a sp. gr. of about 0·93, and the odour and flavour of the see appears to consist of two bodies, a liquid volatile oil, and a c line solid camphor, having the formula, $C^{10}H^{16}(H^2O)^3$, and th isomeric or identical with turpentine-camphor. Essential oil of moms has been found by Luboldt (1860) to be strongly dextr The water which comes over when cardamoms are distilled, co acetic acid. The ash of cardamoms, in common with that of s other plants of the same order, is remarkably rich in manganese.[1]

Commerce—There are no statistics to show the producti cardamoms in the south of India or even the quantity ex The shipments in the year 1872–73 from Bombay, to which t drug is largely sent from the Madras Presidency, amounted to 165 of which 1055 cwt. were exported to the United Kingdom.[2]

Cardamoms, the produce of Ceylon and therefore of the *large* v were exported from that island in 1872, to the extent of 9273 the whole quantity being shipped to the United Kingdom.[3]

Uses—Cardamoms are an agreeable aromatic, often administe conjunction with other medicines. As an ingredient in curry p they have also some use as a condiment. But the consump England is small in comparison with what it is in Russia, Sw Norway and parts of Germany, where they are constantly emplo a spice for the flavouring of cakes. In these countries, Ceylon moms are also used, but exclusively for the manufacture of liqueurs India, cardamoms, besides being used in medicine, are employed condiment and for chewing with betel.

Other sorts of Cardamom.

The fruits of several other plants of the order *Zingiberaceæ* h various times been employed in pharmacy under the common

[1] *Pharm. Journ.* iii. (1872) 208.
[2] *Statement of the Trade, &c. of Bombay* for 1872–73. ii. 58. 90.
[3] *Ceylon Blue Book for* 1872, Col 1873. 543.

We shall here notice only those which have some im-
ıropean or Indian commerce.[1]

· *Cluster Cardamom*—*Amomum Cardamomum* L., the
ɔf this drug, is a native of Cambodia, Siam, Sumatra and

: intercourse with Siam, which was frequent in the early
.7th century, this drug, which is there in common use,
ıund its way into Europe. Clusius received a specimen of
the true *Amomum* of the ancients, and figured it as a great
momum verum, it had a place in the pharmacopœias of this
nson (1640), who figures it as *Amomum genuinum*, says
days it hath been sent to Venice from the East Indies."
ınd Pomet (1694) both regarded it as a rare drug; the
s brought from Holland, and that it is the only thing that
sed when *Amomum* is ordered. In 1751, it was so scarce
; the *Theriaca Andromachi*, some other drug had always
ed for it.[3]
ıad completely disappeared, when about the year 1853,
lations were re-opened with Siam; and among the com-
ed into the market, were *Round Cardamoms*. They were
ɜd, and the importations becoming unprofitable, soon
y are nevertheless an article of considerable traffic in

·damoms are produced in small compact bunches. Each
lar, $\frac{5}{10}$ to $\frac{7}{10}$ of an inch in diameter, marked with longi-
·s, and sometimes distinctly three-lobed. The pericarp
·, somewhat hairy, of a buff colour, enclosing a three-lobed
ɜ, which are mostly shrivelled as if the fruit had been
ɔe. The seeds which have a general resemblance to those
: cardamom, have a strong camphoraceous, aromatic taste.
a large export from Siam of cardamoms of this and
sort. The shipments from Bangkok in 1871, amounted
ls (623,733 ℔.), value 232,464 dollars, and were all to
China.[5] There were also imported into Singapore during
, 102 cwt. from Java, and 75 cwt from Sumatra of [Round?]

l Cardamom; Wild or Bastard Cardamom of Siam—
d by *Amomum xanthioides* Wallich, a native of Tenasserim
During the past twenty years, the seeds of this plant,
ıeir capsules, have often been imported into the London
hey are now also common in the bazaars of India.[7] They
ıle the seeds of the Malabar cardamom, differing chiefly
in being rather more finely rugose. Occasionally they

information on the various
n, consult Guibourt, *Hist.*
9) 215-227; Pereira, *Ele-*
d. ii. (1850) 1128 *et seq.*;
n. Journ. xiv. (1855) 352.
harm., Mai et Juin, 1855.
ibri, 377.
of the Mat. Med., Lond.

[4] Thus 43 bags, imported direct from Bangkok, were offered for sale in London, 26 March, 1857, and bought in at 1*s.* 6*d.* per ℔.

[5] *Commercial Report of H. M. Consul-General in Siam for* 1871.

[6] *Blue Book of the Straits Settlements for* 1871.

[7] Moodeen Sheriff, *Supplement to Pharmacopœia of India*, Madras, 1869. 44. 270.

are imported still cohering in ovoid, three-lobed masses, as packed in the pericarp. Sometimes they are distinguished as *Bastard* or *Wild*, but are more generally termed simply *Cardamom Seeds*. They are a considerable article of trade in Siam, but in commercial returns are not distinguished from the preceding.

The fruits of this species grow in round clusters and are remarkable for having the pericarp thickly beset with weak fleshy spines,[1] which gives them some resemblance to the fruits of a *Xanthium*, and has suggested the specific name.

Bengal Cardamom—This drug, which with the next two has been hitherto confounded under one name,[2] is afforded by *Amomum aromaticum* Roxb., a native of the valleys on the eastern frontier of Bengal. According to Roxburgh,[3] the plant blossoms during the hot season before the periodical rains, and matures its fruit in September; the latter is then gathered and sold to the drug dealers, under the name of *Morung Elachi*.

Bengal cardamoms[4] average about an inch in length, and are of ovoid or slightly obconic form, and obscurely 3-sided; the lower end is rounded and usually devoid of stalk. The upper part of the fruit is provided with 9 narrow jagged wings or ridges, which become apparent after maceration; and the summit terminates in a truncate bristly nipple,—never protracted into a long tube. The pericarp is coarsely striated, and of a deep brown. It easily splits into 3 valves, inclosing a 3-lobed mass of seeds, 60 to 80 in number, agglutinated by a viscid saccharine pulp, due to the aril with which each seed is surrounded. The seeds are of roundish form, rendered angular by mutual pressure, and about $\frac{1}{8}$ of an inch long; they have a highly aromatic, camphoraceous taste.

Nepal Cardamom—The description of the Bengal cardamom applies in many points to this drug, to which it has a singularly close resemblance. The fruit is of the same size and form, and is also crowned in its upper part with thin jagged ridges, and marked in a similar manner with longitudinal striæ; and lastly, the seeds have the same shape and flavour. But it differs, firstly, in bearing on its summit a tubular claw which is as long or longer than the fruit itself; and secondly, in the fruit being often attached to a short stalk. The fruits are borne on an ovoid scape, 3 to 4 inches long, densely crowded with overlapping bracts which are remarkably broad and truncate with a sharp central claw—very distinct from the much narrower ovate bracts of *A. aromaticum*, as shown in Roxburgh's unpublished drawing of that plant.

The plant, which is unquestionably a species of *Amomum*, has not yet been identified with any published description. We have to thank Colonel Richard C. Lawrence, British Resident at Katmandu, for sending us a fruit-scape in alcohol, some dried leaves, and also the drug itself—the last agreeing perfectly with specimens obtained through other channels.

[1] See figure in *Pharm. Journ.* xiv. (1855) 418.

[2] As by Pereira, *Elem. of Mat. Med.* ii. 1850) 1135.

[3] *Flora Indica*, Serampore, i. (1832) 45.

[4] Mr. John Scott, of the Royal Botanical Gardens, Calcutta, has been good enough to send us a large sample of Bengal cardamoms which he says are best known in the bazaars as *Buro Elachi*. They quite agree with specimens previously in our possession.

pal cardamom, the first account of which is due to Hamilton,[1] d on the frontiers of Nepal near Darjiling. The plant is Col. Lawrence to attain 3 to 6 feet in height, and to be well-watered slopes of the hills, under the shelter of trees. exported to other parts of India.

Cardamom—A well-marked fruit, produced by *Amomum* Roxb., a plant of Java. The fruits are arranged to the 30 to 40 on a short thick scape, and form a globose group, diameter. They are stalked, and of a conical or ovoid form, state as much as 1½ inches long, by 1 inch broad. Each ided with 9 to 10 prominent wings, ⅛ of an inch high, running to apex, and coarsely toothed except in their lowest part. t is crowned by a short, withered, calycinal tube.

mendyk, of the Botanical Garden of Buitenzorg, in Java, who supplied us with fine specimens of *A. maximum*, as well as mirable coloured drawing, states that the plant is cultivated, ts fruits are sold for the sake of their agreeable edible pulp. know whether the dried fruits or the seeds are ever exported. ifounded them with Bengal and Nepal cardamoms.

ma Cardamom—The Arab physicians were acquainted with rdamom called *Heil*, which was later known in Europe and is in the most ancient printed pharmacopœias, as *Cardamomum* ike some other Eastern drugs, it gradually disappeared from commerce, and its name came to be transferred to *Grains of* which to the present day are known in the shops as *Semina i majoris.*

e *Cardamomum majus* is a conical fruit, in size and shape not mall fig reversed, containing roundish angular seeds, of an aromatic flavour, much resembling that of the Malabar and quite devoid of the burning taste of grains of paradise. is perforated, having been strung on a cord to dry; such cardamoms are sometimes used by the Arabs as rosaries. question is called in the Galla language *Korarima*, but it is as *Gurági* spice, and by its Arabic names of *Heil* and *Hab-i*.[3] According to Beke, it is conveyed to the market of Báso n Abyssinia from Tumhé, a region lying in about 9° N. lat. long; thence it is carried to Massowah on the Red Sea and India and Arabia.[4] Von Heuglin[5] speaks of it as brought alla country. It is not improbable that it is the same fruit ke[6] saw growing in 1862, at Uganda in lat. 0°, and which he ng like a necklace by the Wagonda people. Pereira proposed nt the name of *Amomum Korarima*, but it has never been described.

f the Kingdom of Nepal, Edinb.

aurus Aromatariorum, printed 496, in which it is called *Heil um majus.*

l by Forskal in 1775 (*Materia rica*, 151. n. 41) who says "*frequens in re culinarid et medicd, loco piperis.*"

[4] Pereira, *Pharm. Journ.* vi. (1847) 466; *Elem. of Mat. Med.* ii. (1850) 1136; Vaughan, *Pharm. Journ.* xii. (1853) 587.

[5] *Reise nach Abessinien*, Jena, 1868. 223.

[6] *Journal of the discovery of the source of the Nile*, 1863. 648 (appendix).

GRANA PARADISI.

Semina Cardamomi majoris, Piper Melegueta; Grains of Pa Guinea Grains, Melegueta Pepper[1]; F. *Graines de Paradis, Mani* G. *Paradieskörner.*

Botanical Origin—*Amomum Melegueta* Roscoe—an herb reed-like plant, 3 to 5 feet high, producing on a scape rising scare inch above the ground, a delicate wax-like, pale purple flower, wl succeeded by a smooth, scarlet, ovoid fruit, 3 to 4 inches in length, out of sheathing bracts.

It varies considerably in the dimensions of all its parts, accord more or less favourable circumstances of soil and climate. In Dem where the plant grows luxuriantly in cultivation, the fruit is as lu a fine pear, measuring with its tubular part as much as 5 inches in l by 2 inches in diameter; on the other hand in some parts of Africa, it scarcely exceeds in size a large filbert. It has a thick f pericarp, enclosing a colourless acid pulp of pleasant taste, in whic imbedded the numerous seeds.

A. Melegueta is widely distributed in tropical West Africa, occu along the coast region from Sierra Leone to Congo. Of its distrib in the interior, we have no exact information. The littoral region, te in allusion to its producing grains of paradise, the *Grain Coast*, between Liberia and Cape Palmas; the Gold Coast whence the are now principally exported, is in the Gulf of Guinea, further east

History—There is no evidence that the ancients were acqua with the seeds called *Grains of Paradise;* nor can we find any refe to them earlier than an incidental mention under their African nam the account[2] of a curious festival held at Treviso in A.D. 1214: it a sort of tournament, during which a sham fortress held by twelve n ladies and their attendants, was besieged and stormed by assailants ar with flowers, fruits, sweetmeats, perfumes and spices, amongst which figure—*Melegetæ!*

After this period there are many notices, showing the seeds to l been in general use. Nicolas Myrepsus,[3] physician at the court of Emperor John III. at Nicæa, in the 13th century, prescribed Μελεγέ and his contemporary Simon of Genoa[4] at Rome, names the same as *Melegete* or *Melegette. Grana Paradisi* are enumerated among sp sold at Lyons[5] in 1245; and, as *Greyn Paradijs*, in a tariff of du levied at Dordrecht in Holland[6] in 1358. And again, among the sp used by John, king of France when in England, A.D. 1359–60, *Gra de Paradis* is repeatedly mentioned.[7]

[1] The name *Melegueta* spelt in various ways, as *Melegette, Melligetta, Mallaguetta, Manigete, Maniguette*, is an African designation for grains of Paradise.

[2] Rolandini Patavini Chronica—Pertz, *Monumenta Germaniæ historica; scriptores*, xix. (1866) 45–46.

[3] *De Compositione Medicamentorum; de antidotis*, cap xxii.

[4] *Clavis Sanationis*, Venet. 1510. 19.

[5] *Bibliothek d. lit. Vereins*, Stuttgart, p. xxiii.

[6] Sartorius und Lappenberg, *Gesch der Deutschen Hansa*, ii. 448.

[7] Doüet d'Arcq, 219. 266—see p note 4.

In the earliest times, the drug was conveyed by the long land journey ›m Tropical Africa to the coast of Tripoli,[1] as it is in small quantities › to the present day; and being the produce of an unknown region and ld in great esteem, it acquired the name of *Grains of Paradise*.

Towards the middle of the 14th century, there began to be direct mmercial intercourse with Tropical Western Africa. Margry [2] relates at ships were sent thither from Dieppe in 1364, and took cargoes of ory and *malaguette*, from near the mouth of the river Cestos. A ntury later, the coast was visited by the Portuguese, who termed it *rra de malaguet*. The celebrated Columbus also, who traded to the ast of Guinea, called it *Costa di Maniguetta*. Soon after this period, e spice became a monopoly of the kings of Portugal.

English voyagers visited the Gold Coast in the 16th century, bringing ence in exchanging for European goods, gold, ivory, pepper, and *Grains Paradise*.[3] The pepper was doubtless that of *Piper Clusii* (p. 530).

Grains of paradise, often called simply *grains*, were anciently used a condiment like pepper. They were also employed with cinnamon d ginger in making the spiced wine called *hippocras*, in vogue during e 14th and 15th centuries.

In the hands of modern botanists, the plant affording this drug has en the subject of a complication of errors which it is needless to discuss. ffice it to say, that *Amomum Granum Paradisi* as described by innæus cannot be identified;—that in 1817, Afzelius, a Swedish tanist, who resided some years at Sierra Leone, published a descrip- n of "*Amomum Granum Paradisi ?* Linn.,"[4] but that the specimen of alleged to have been received from him, and now preserved in the rbarium of Sir J. E. Smith, belongs to another species. Under these cumstances, the name given to the grains of paradise plant by Roscoe, *Melegueta*, has been accepted as quite free from doubt.[5]

Description—The seeds are about $\frac{1}{10}$ of an inch in diameter, rather riable in form, being roundish, bluntly angular or somewhat pyramidal. ey are hard, with a shining, reddish-brown, slmgreen-like surface. The um is beak-shaped and of paler colour. The seeds when crushed are bly aromatic, but have a most pungent and burning taste.

Microscopic Structure—In structure, grains of paradise agree in st respects with cardamom seeds. Yet in the former, the cells of the umen have very thin, delicate walls which are much more elongated. the testa, only the innermost layer agrees with the corresponding part ardamom; whilst the middle layer has the cell walls so much thickened only a few cavities, widely distant from one another, remain open. outer layer of the testa consists of thick-walled cells, the cavities of ch appear on transverse section, radially extended. The albumen is ed with starch granules of 2 to 5 mkm. diameter, the whole amount ach cell being agglutinated, so as to form a coherent mass.

Chemical Composition—Grains of paradise contain a small pro-

. di Barros, *Asia*, Venet. 1561. 33 (65).
uoted at p. 530, note 3.
akluyt, *Principal Navigations*, ii. pt. irst Voiage of the *Primerose* and *Lion* nea and Benin, A.D. 1553.
:media Guineensia. Upsaliæ. p. 71.

[5] I have repeatedly raised *Amomum Melegueta* from commercial Grains of Paradise, and have cultivated the plant for some years, obtaining not only flowers, but large well-ripened fruits containing fertile seeds.—D. H.

portion of essential oil; 53 lb. yielded us only 2¼ oz., eq to nearly 0·30 per cent.[1] The oil is faintly yellowish, neutra agreeable odour reminding one of the seeds, and of an aromatic, r taste. It has a sp. gr. at 15·5° C., of 0·825. It is but sparingly so absolute alcohol or in spirit of wine; but mixes clearly with bi of carbon; it dissolves iodine without explosion. When saturat dry hydrochloric gas, no solid compound is formed.

The oil begins to boil at about 236° C., and the chief bu distils at 257°–258°: the residual part is a thick brownish Examined in a column of 50 mm. long, the crude oil deviates the left. The portion passing over at 257°–258° deviates 1·2°, the 2° to the left. The optical behaviour is consequently in favour supposition that the oil is homogeneous. This is corroborated results of three elementary analyses which lead to the f $C^{20}H^{32}O$, or $C^{10}H^{16} + C^{10}H^{16}O$.

In order to ascertain whether the seed contains a fatty grammes, powdered with quartz, were exhausted with boiling ether gave upon evaporation 0·583 grm. of a brown viscid residue, devoid of odour, but of intense pungency. As it was entirely in glacial acetic acid or in spirit of wine, we may consider it a res not to contain any fatty matter.

The seeds, dried at 100° C., afforded us 2·15 per cent. of ash, owing to the presence of manganese, had a green hue.

Commerce—Grains of paradise are chiefly shipped from the ments on the Gold Coast, of which Cape Coast Castle and Accra a more important. Official returns[2] show that the exports in 1871 this district, were as follows:—to Great Britain 85,502 lb., the U States 35,630 lb., Germany 28,501 lb., France 27,125 lb., Ho 14,250 lb.—total, 191,011 lb. (1705 cwt.)

Uses—The seeds are used in cattle medicines, occasionally condiment, but chiefly, we believe, to give a fiery pungency to cordi

ORCHIDACEÆ.

SALEP.

Radix Salep, Radix Satyrii; Salep; F. *Salep;* G. *Salepknolle*

Botanical Origin—Most, if not all, species of *Orchis* foun Europe and Northern Asia, are provided with tubers which, when prepared, are capable of furnishing salep. Of those actually so used following are the more important, namely—*Orchis mascula* L., *O.* L., *O militaris* L., *O. ustulata* L., *O. pyramidalis* L., *O. coriophora* L *O. longicruris* Link. These species which have the tubers *entir* natives of the greater part of Central and Southern Europe, Turke Caucasus and Asia Minor.[3]

[1] This oil was obtained and tried in medicine in the beginning of the 17th century.—Porta, *De Distillatione*, Romæ, 1608, lib. iv. c. 4.

[2] *Blue Book for the Colony of th Coast in* 1871.

[3] Tchihatcheff enumerates 36 sp *Orchis* as occurring in Asia Min *Mineure*, Bot. ii. 1860.

ing species with *palmate* or *lobed* tubers have a geographical extensive, namely, *O. maculata* L., *O. saccifera* Brongn., and *O. latifolia* L. The last-named reaches North-Western ɔet; and *O. conopsea* occurs in Amurland in the extreme

of the Indian bazaars, known as *Sálib misrí*, for fine vhich the most extravagant prices are paid by wealthy erived from certain species of *Eulophia*, as *E. campestris* ɔacea Lindl., and probably others.[1]

-Under the superstitious influence of the so-called *doctrine* salep[2] has had for ages a reputation in Eastern countries ıt of the generative powers; and many Europeans who India, although not prepared to admit the extravagant d to it by Hindus and Mahommedans, yet regard it as a ent in the sick room.

was known to Dioscorides and the Arabians, as well as ists and physicians of the middle ages, by whom it was bed in the fresh state. Gerarde (1636) has given excellent various orchids whose tubers, says he—"*our age useth.*" having recognized the salep imported from the Levant to of an orchis, pointed out in 1740 how it might be prepared ies indigenous to France.

n—The tubers are dug up after the plant has flowered, and ones having been thrown aside, those which are plump are g on threads and scalded. By this process their vitality is l the drying is easily effected by exposure to the sun or to ial heat. Though white and juicy when fresh, they become d and horny, and lose their bitterish taste and peculiar drug found in English trade is mostly imported from at sold in Germany is partly obtained from plants growing Taunus mountains, Westerwald, Rhön, the Odenwald, and alep is also collected in Greece, and used in that country the form of decoction, which is sweetened with honey and arly morning drink.[4] The salep of India is produced on Afghanistan, Beluchistan, Kabul and Bokhara;[5] the Neil- n the south, and even Ceylon, are said likewise to afford it.

ion—Levant salep, such as is found in the English market, bers half an inch to an inch in length, of ovoid or oblong ointed at the lower end, and rounded at the upper where is ar left by the stem; palmate tubers are unfrequent. They shrunken and contorted, covered with a roughly granular wn, translucent, very hard and horny, with but little odour ıot unpleasant taste. After maceration in water for several

species of *Eulophia* have Lindley in *Journ. of Linn.* 59) 23.

Arabic for *fox*, and the drug anguage *Khus yatu's salab*, or *Khus yatu'l kalb*, i.e. e word *Orchis*, and the old *Doystones*, *Foxstones*, *Hare-stones* and *Goatstones*, have all been given in allusion to the form of the tubers.

[3] *Mém. de l'Acad. des Sciences for* 1740. 99.

[4] Heldreich, *Nutzpflanzen Griechenlands*, Athen, 1862. 9.

[5] Powell, *Economic Products of the Punjab*, Roorkee, i. (1868) 261; Stewart, *Punjab Plants*, Lahore, 1869. 236.

Chemical Composition—The most important constituer is a sort of mucilage, the proportion of which according to D (1865) amounts to 48 per cent.; but it is doubtless subjec variation. Salep yields this mucilage to cold water, forming which is turned blue by iodine, and mixes clearly with neutral lead like gum arabic. On addition of ammonia, an abundant p is formed. Mucilage of salep precipitated by alcohol and the coloured violet or blue, if moistened with a solution of iodine of potassium. The dry mucilage is readily soluble in an solution of oxide of copper; when boiled with nitric acid, c not mucic acid is produced. In these two respects, the m salep agrees with cellulose, rather than with gum arabic. In cells in which it is contained, it does not exhibit any stratifi that its formation does not appear due to a metamorphosis of wall itself. Mucilage of salep contains some nitrogen and matter, of which it is with difficulty deprived by repeated pre by alcohol.

It is to the mucilage just described that salep chiefly owes of forming with even 40 parts of water a thick jelly, which still thicker on addition of magnesia or borax. The starch assists in the formation of this jelly; yet its amount is very even *nil* in the tuber bearing the flowering stem, whereas t lateral tuber abounds in it. The starch so deposited is evide sumed in the subsequent period of vegetation, thus explainin that tubers are found, the decoction of which is not rendered iodine. Salep contains also sugar and albumin, and when fres of volatile oil. Dried at 110° C., it yields 2 per cent. of ash, c chiefly of phosphates and chlorides of potassium and calcium

VANILLA.

Vanilla;[1] F. *and* G. *Vanille.*

Botanical Origin—*Vanilla planifolia* Andrews—Indigenous to the ›t regions (*tierra caliente*) of Eastern Mexico, diffused by cultivation ırough other tropical countries. The plant, which is rather fleshy and ıs large greenish inodorous flowers, grows in moist, shady forests, imbing the trees by means of its aërial roots.

History—The Spaniards found vanilla in use in Mexico as a condi- .ent to chocolate, and by them it was brought to Europe; but it must ıve long remained very scarce, for Clusius, who received a specimen ı 1602 from Morgan, apothecary to Queen Elizabeth, described it as *obus oblongus aromaticus*, without being in the least aware of its native ›untry or uses.[2] In the *Thesaurus* of Hernandez, there is a figure and :count of the plant under the name of *Araco aromatico*.[3]

In the time of Pomet (1694), vanilla was imported by way of Spain, ıd was much used in France for flavouring chocolate and scenting ›bacco. It had a place in the materia medica of the London Pharma- ›pœia of 1721; and was well known to the druggists of the first half of ıe 18th century, after which it seems to have gradually disappeared om the shops. Of late times it has been imported in great abundance, ıd is now plentifully used, not only by the chocolate manufacturer, but lso by the cook and confectioner.

Cultivation—The culture of vanilla is very simple. Shoots about ıree feet long having been fastened to trees and scarcely touching the ·ound, soon strike roots on to the bark, and form plants which commence produce fruit in three years, and remain productive for thirty to forty.

The fertilization of the flower is naturally brought about by insect ·ency. Morren,[4] the director of the Botanical Garden of Liége, showed 1837 that it might be efficiently performed by man,[5] since which the oduction of the pods has been successfully carried on in all tropical untries without the aid of insects. Even in European forcing houses, : plant produces fruits of full size, which for aroma bear comparison th those of Mexico.

In vanilla plantations, the pods are not allowed to arrive at com- te maturity but are gathered when their green colour begins to change. cording to the statements of De Vriese,[6] they are dried by a rather :uitous process, namely by exposing them to heat alternately un- ered, and wrapped in woollen cloths, whereby they are artificially ›ned and acquire their ultimate aroma and dark hue. They are then l together into small bundles.

Description—The fruit when fresh is of the thickness of the little

Diminutive of the Spanish *vaina*, a pod psule.

Exotica (1605) lib. iii. c. 18. 72.

Rerum Medicarum Novæ Hispaniæ The- us, Romæ, 1651. p. 38.—The original ing was one of a series of 1200, executed at cost in Mexico by order of the King of Spain during the previous century.

[4] *Ann. of Nat. Hist.* iii. (1839) 1.

[5] This observation was made independently by Edmond, a Creole of the island of Réunion, shortly after 1817.

[6] *De Vanielje*, Leyden, 1856. 22.

finger, obscurely triquetrous, opening longitudinally by two unequal valves. It is fleshy, firm, smooth and plump; when cut transversely, it exudes an inodorous slimy juice, abounding in spiculæ of oxalate of calcium.[1] It is one-celled, with a three-sided cavity, from each wall of which projects a two-branched placenta, each branch subdividing into two backward-curling lobes. There are thus in all 12 ridges, which traverse the fruit lengthwise, and bear the seeds. Fine hair-like papillæ line as a thick fringe the three angles of the cavity, and secrete the odorous matter, which after drying is diffused through the whole pod. The papillæ likewise contain drops of oil, which is freely absorbed by the paper in which a pod is wrapped. That the odorous matter is not resident in the fleshy exterior mass, we have ascertained by slicing off this portion of a fresh fruit and drying it separately; the interior alone proved to be fragrant.

The vanilla of commerce occurs in the form of fleshy, flexible, stick-like pods, 3 to 8 inches long, and $\frac{3}{10}$ to $\frac{4}{10}$ of an inch wide, of a compressed cylindrical form, attenuated and hooked at the stalk end. The surface is finely furrowed lengthwise, shining, unctuous, and often beset with an efflorescence of minute colourless crystals. The pod splits lengthwise into two unequal valves, revealing a multitude of minute, shining, hard, black seeds of lenticular form, imbedded in a viscid aromatic juice.

The finest vanilla is the Mexican. *Bourbon Vanilla*, which is the more plentiful, is generally shorter and less intense in colour, and commands a lower price.

Microscopic Structure—The inner half of the pericarp contains about 20 vascular bundles, arranged in a diffuse ring. The epidermis is formed of a row of tabular thick-walled cells, containing a granular brown substance. The middle layer of the pericarp is composed of large thin-walled cells, the outer of which are axially extended, while those towards the centre have a cubic or spherical form. All contain drops of yellowish fat, and brown granular masses which do not decidedly exhibit the reaction of tannin. The tissue further encloses needles of oxalate of calcium and prisms of vanillin.

On the walls of the outer cells of the pericarp[2] are deposited spiral fibres, which occur still more conspicuously in the aërial roots and in the parenchyme of the leaves of other orchids. The placentæ are coated with delicate, thin-walled cells.

Chemical Composition—Vanilla does not contain an essential oil, but owes the fragrance for which it is remarkable, to the substance which is found in a crystalline state in the interior or on the surface of the fruit, or dissolved in the viscid oily liquid surrounding the seeds. It was formerly regarded as cinnamic or benzoic acid, and then as cumarin, until Gobley demonstrated its peculiar nature (previously asserted by Bley) and gave it the name of *Vanilline*, now changed to *Vanillin*.[3]

[1] This juice like that of the squill has an irritating effect on the skin, a fact of which the cultivators in Mauritius are well aware.

[2] Vanilla grown in Europe is devoid of such cells. We can fully corroborate this statement (first made by Berg) from an examination of very aromatic pods produced in 1871 at Hillfield House, Reigate.

[3] *Journ. de Pharm.* xxxiv. (1858) 401.

Stokkebye[1] proved vanillin to possess feebly acid properties, and in consequence termed it *Vanillic Acid.* It may be obtained in the following manner: vanilla is exhausted by alcohol sp. gr. ·850, and the alcohol removed by evaporation. To the extract, sufficient water is to be added to form a syrupy liquid, which is then to be agitated with successive quantities of ether. The ether having evaporated, an odorous brown extract will remain; from it the vanillin may be dissolved out by boiling water and crystallized, and afterwards purified by animal charcoal. Vanillin forms hard, 4-sided, acicular prisms, having a weak vanilla-like odour and slightly pungent taste; they fuse at 82° C. and can be sublimed, though not easily, unchanged. It is soluble in ether or spirit of wine, especially warm; and the solution in each case feebly reddens litmus. It dissolves in 11 parts of boiling water, is soluble in fatty and volatile oils, and in alkaline solutions, from which last it can be precipitated unaltered by addition of a stronger acid. It does not decompose carbonates even when heated. With chemical reagents, its most interesting character is that of striking a fine dark violet with perchloride of iron.

A later student of the chemistry of vanillin, P. Carles,[2] assigned to it the formula $C^{16}H^{8}O^{6}$. He obtained crystallized compounds of it with magnesium, lead and zinc. The vanillates of potassium and sodium darken on exposure to air, or when their watery solutions are heated. One or two equivalents of hydrogen are easily replaced by iodine or bromine, the compounds thus obtained being crystallizable.

W. von Leutner[3] extracted from vanilla nearly 1 per cent. of vanillin, which he found to afford with 182 parts of water at 18° C., a solution reddening litmus.

Some interesting researches performed in Hofmann's laboratory at Berlin by Tiemann and Haarmann, have shown (1874) that vanillin may be formed artificially. In the sapwood of pines, there occurs a substance called *Coniferin*, $C^{16}H^{22}O^{8} + 2\ H^{2}O$, first observed in 1861 by Hartig, and examined in 1866 by Kubel. By means of emulsin, coniferin taking up $H^{2}O$, can be resolved into sugar and another crystallizable substance, according to the following equation:—$C^{16}H^{22}O^{8} + H^{2}O = C^{6}H^{12}O^{6} + C^{10}H^{12}O^{3}$. The second substance thus derived, may be collected by means of ether, which dissolves neither coniferin nor sugar. By oxidizing it, or coniferin itself, by bichromate of potassium and sulphuric acid, *Vanillin* was obtained. Upon fusing it with potash, *Protocatechuic Acid*, $C^{7}H^{6}O^{4}$, is formed. In fact, according to these researches, vanillin, $C^{16}H^{8}O^{6}$, must be regarded as the methylic aldehyde of that acid. This view is confirmed by the decomposition that ensues on heating vanillin in a closed tube with hydrochloric acid, during which methylic chloride, $CH^{3}Cl$, is formed.

Leutner also found in vanilla, fatty and waxy matters 11·8, resin 4·0, gum and sugar 16·5 per cent.; and obtained by incineration of the drug 6 per cent. of ash.

Production and Commerce—The chief seats of vanilla-production in Mexico are the coast-regions of the State of Vera Cruz, the centre of

Wittstein's *Vierteljahresschrift f. prakt. Pharm.* xiii. (1864) 481.

Journ. de Pharm. xii. (1870) 254; *Bull. de la Soc. chimique de Paris*, xvii. (1872) 12.

[3] Wiggers and Husemann, *Jahresbericht für* 1872. 35.

the culture being Jicaltepec in the vicinity of Nautla.[1] Vanilla is likewise obtained on the western declivity of the Cordilleras in the State of Oaxaca, and in lesser quantity in those of Tabasco, Chiapas, and Yucatan. The eastern parts of Mexico exported in 1864, by way of Vera Cruz and Tampico, about 20,000 kilo. of vanilla, chiefly to Bordeaux. Since then, the production seems to have much declined, the importation into France having been only 6869 kilo in 1871, and 1938 in 1872.[2]

The cultivation of vanilla in the small French colony of Réunion or Bourbon (40 miles long by 27 miles broad), introduced by Marchant in 1817 from Mauritius, has of late been very successful, notwithstanding many difficulties occasioned by the severe cyclones which sweep periodically over the island; in 1871, the quantity exported was 39,200 lb.[3] The neighbouring island of Mauritius also produces vanilla, of which it shipped in 1872, 7139 lb.[4] There is likewise a very extensive cultivation of vanilla in Java.

Vanilla comes into the market chiefly by way of France, which country, according to the official statistics just quoted, imported in 1871, 29,914 kilo. (65,981 lb.); in 1872, 26,587 kilo. (58,643 lb.) Of the last-named quantity, only about half was retained for home consumption.

Uses—Vanilla has long ceased to be used in medicine, at least in this country, but is often sold by druggists for flavouring chocolate, ices, creams, and confectionary.

IRIDACEÆ.

RHIZOMA IRIDIS.

Radix Iridis Florentinæ; Orris Root; F. *Racine d'Iris;* G. *Veilchenwurzel.*

Botanical Origin—This drug is derived from three species of *Iris*, namely:—

1. *Iris Germanica* L., a perennial plant with beautiful large deep blue flowers, common about Florence and Lucca, ascending to the region of the chestnut. It is also found dispersed throughout Central and Southern Europe, and in Northern India and Morocco; and is one of the commonest plants of the gardens round London, where it is known as the *Blue Flag.*

2. *I. pallida* Lam., a plant resembling the preceding, but with flowers of a delicate pale blue, growing wild in stony places in Istria. It is abundant about Florence and Lucca in the region of the olive, but is a doubtful native.

3. *I. Florentina* L., a species bearing large white flowers, indigenous to the coast region of Macedonia and the south-western shores of the

[1] *Culture du vanillier au Mexique*, in the *Revue Coloniale*, ii. (1849) 383–390.

[2] *Documents Statistiques réunis par l'Administration des Douanes sur le Commerce de la France*, année 1872, p. 64.

[3] Consul Segrave of Réunion in the *Consular Reports*, presented to Parliament, Aug. 1872.

[4] *Mauritius Blue Book for the year* 1872.

Black Sea, Hersek in the Gulf of Ismid, and about Adalia in Asia Minor. It also occurs in the neighbourhood of Florence and Lucca, but in our opinion only as a naturalized plant.[1]

These three species, but especially *I. Germanica* and *I. pallida*, are cultivated for the production of orris root in the neighbourhood of Florence. They are planted on the edges of terraces and on waste, stony places contiguous to cultivated ground. *I. Florentina* is seldom found beyond the precincts of villas, and is far less common than the other two.

History—In ancient Greece and Rome, orris root was largely used in perfumery; and Macedonia, Elis, and Corinth were famous for their unguents of iris.[2] Theophrastus and Dioscorides were well acquainted with orris root; the latter, as well as Pliny, remarks that the best comes from Illyricum, the next from Macedonia, and a sort still inferior from Libya; and that the root is used as a perfume and medicine. Visiani[3] considers that *Iris Germanica* is the Illyrian iris of the ancients, which is highly probable, seeing that throughout Dalmatia (the ancient Illyricum) that species is plentiful, and *I. Florentina* and *I. pallida* do not occur. At what period the two latter were introduced into Northern Italy we have no direct evidence, but it was probably in the early middle ages. The ancient arms of Florence, a white lily or iris on a red shield, seem to indicate that that city was famed for the growth of these plants. Petrus de Crescentiis[4] of Bologna, who flourished in the 13th century, mentions the cultivation of the *white* as well as of the purple iris, and states at what season the root should be collected for medicinal use.

But the true Illyrian drug was held to be the best; and Valerius Cordus[5] (ob. 1544) laments that it was being displaced by the Florentine, though it might easily be obtained through the Venetians.

Orris root mixed with anise was used in England as a perfume for men as early as 1480 (p. 277), under which date it is mentioned in the *Wardrobe Accounts* of Edward IV.

All the species of iris we have named were in cultivation in England in the time of Gerarde,—that is, the latter end of the 16th century. The orris of the rhizome was formerly reckoned medicinal, and directions for its preparation are to be found in the *Traicté de la Chymie* of Le Febvre, published in 1660.

Production—The above-mentioned species of iris are known to the Tuscan peasantry by the one name of *Giaggiolo*. The rhizomes are collected indiscriminately, the chief quantity being doubtless furnished by the two more plentiful species, *I. Germanica* and *I. pallida*. They are dug up in August, are then peeled, trimmed, and laid out in the sunshine to dry, the larger bits cut off being reserved for replanting. At the establishment

From observations made at Florence in the spring of 1872, I am led to regard the three species here named as quite distinct. The following comparative characters are perhaps worth recording:—

I. Germanica—flower-stem scarcely 1½ times as tall as leaves; flowers more crowded than in *I. pallida*, varying in depth of colour never pale blue.

I. pallida—bracts brown and scariose; flower-stem twice as high as leaves.

I. Florentina—bracts green and fleshy; flower-stem short as in *I. Germanica*; is a more tender plant than the other two and blossoms a little later.—D. H.

[2] For further information, consult Blümner, *Die gewerbliche Thätigkeit der Völker des klassischen Alterthums*, 1869. 57. 76. 83.

[3] *Flora Dalmatica*, i. (1842) 116.

[4] *De omnibus agriculturæ partibus*, Basil. 1548. 219.

[5] *Dispensatorium*, Norimb, 1529. 288.

are evidently in a state of decay. These joints are mostly dicl
subcylindrical, a little compressed vertically, gradually beco
conical, and attaining a maximum size when about three y
They are 3 to 4 inches long and sometimes more than 2 incl
Those only of the current year emit leaves from their ex
The rhizome is externally yellowish-brown, internally white a
with an earthy smell and acrid taste. By drying, it gradually
its pleasant violet odour, but it is said not to attain its max
fragrance until it has been kept for two years.

We have carefully compared with each other the fresh rhi
the three species under notice, but are not able to point out any
character for distinguishing them apart.

Dried orris root as found in the shops, occurs in pieces of 2 to
long, and often as much as 1¼ inches wide. A full-sized piece
consist of an elongated, irregularly subconical portion emitti
broader end one or two (rarely three) branches which, having
short in the process of trimming, have the form of short, broad
tached by their apices to the parent rootstock. The rootstock is
somewhat arched, often contorted, shrunken and furrowed. T
side is marked with small circular scars, indicating the point of in
rootlets. The brown outer bark has been usually entirely ren
peeling and paring; and the dried rhizome is of a dull, opaq
ponderous, firm and compact. It has an agreeable and delicate
violets, and a bitterish, rather aromatic taste, with subsequent a

A sort of orris root which has been dried without the remov
outer peel, is found under the name of *Irisa* in the Indian baz
now and then in the London market. It is, we suppose, the p
Iris Germanica L. (*I. Nepalensis* Wall.), which according to E

ade up uniformly of large thick-walled spherical porous cells, loaded ith starch granules, which are oval, rather large and very numerous; isms of calcium oxalate are also visible. The spiral vessels are nall and run in very various directions. The foregoing description applicable to any one of the three species we have named.

Chemical Composition—When orris root is distilled with water, solid crystalline substance, called *Orris Camphor*, is found floating the aqueous distillate. This substance, which we obtained from e laboratory of Messrs. Herrings & Co. of London, is yielded, as we arn from Mr. Umney, to the extent of 0·12 per cent.—that is to say, cwt. 3 qrs. 23 lb. of rhizome afforded of it 8½ ounces.[1] We have purified it means of charcoal, and recrystallization from dilute alcohol, when we ally got it in very light voluminous scales, which fuse at 51·5° C., but not volatilize to any considerable extent even at 150°. These crystals e found to contain on an average of three analyses, carbon 73·96, and drogen 12·26 per cent. This leads to the formula $C^{14}H^{28}O^2$, which that of *Myristic Acid* (see p. 455). The crystals have an acid reaction; ey are easily soluble in caustic alkali, and are again separated by an id:—in fact, we believe them to be simply myristic acid, impregnated th a little essential oil which they obstinately retain. The results tained by Dumas in 1835, do not accord with ours.

By exhausting orris root with spirit of wine, a soft brownish resin is tained, together with a little tannic matter. The resin has a slightly id taste; the tannin strikes a green colour with persalts of iron.

Commerce—Orris root is shipped from Leghorn, Trieste and gador,—from the last-named port, to the extent in 1872 of cwt.[2] There are no data to show the total imports into Great tain. France imported in the year 1870, about 50 tons of orris t.

Uses—Frequently employed as an ingredient in tooth-powders, and France for making issue-peas; but the chief application is as a fume.

CROCUS.

Croci stigmata; Saffron;[3] F. *and* G. *Safran.*

Botanical Origin—*Crocus sativus* L., a small plant with a fleshy, -like corm and grassy leaves, much resembling the common Spring us of the gardens, but blossoming in the autumn. It has an elegant le flower, with a large orange-red stigma, the three pendulous ions of which are protruded beyond the perianth.

The Saffron Crocus is supposed to be indigenous to Greece, Asia or, and perhaps Persia, but it has been so long under cultivation in East that its primitive home is somewhat doubtful.[4]

[1] ie produce of some previous operations, ich 23 cwt. of orris were distilled, d but little over one-tenth per cent. *nsular Reports*, Aug. 1873. 917.

[3] ie word *Saffron* is derived from the *Asfar*, yellow.

[4] Chappellier has pointed out that *Crocus sativus* L. is unknown in a wild state, and that it hardly ever produces seed even though artificially fertilized; and has argued from these facts that it is probably a hybrid.—*Bulletin de la Soc. bot. de France*, xx. (1873) 191.

History—Saffron, either as a medicine, condiment, perfume, has been highly prized by mankind from a remote period, and has an important part in the history of commerce.

Under the Hebrew name *Carcôm*, which is supposed to be tl of the word *Crocus*, the plant is alluded to by Solomon;[1] and as l by Homer, Hippocrates, Theophrastus, and Theocritus. Virg Columella mention the saffron of Mount Tmolus; the latter also that of Corycus in Cilicia, and of Sicily, both which localities are a to as celebrated for the drug by Dioscorides and Pliny.

Saffron was an article of traffic on the Red Sea in the first ce and the author of the Periplus remarks that Κρόκος is exporte Egypt to Southern Arabia, and from Barygaza in the gulf of Cam

It was cultivated at Derbend and Ispahan in Persia, and in Trans in the 10th century,[3] whence it is not improbable the plant was c to China, for according to the Chinese it came thither from the c of the Mahommedans. Chinese writers have recorded that und Yuen dynasty (A.D. 1280–1368), it became the custom to mix *Sa-fi* (Saffron) with food.[4]

There is evidence to show that saffron was a cultivated producti Spain[5] as early as A.D. 961; yet it is not so mentioned, but only eastern drug, by St. Isidore, archbishop of Seville in the 7th cen As to France, Italy, and Germany, it is commonly said that the s crocus was introduced into these countries by the Crusaders. Porch a French nobleman, is stated to have brought some bulbs to Avi towards the end of the 14th century, and to have commenced cultivation in the Comtat Venaissin, where it existed down to n times. About the same time, the growing of saffron is said to been introduced by the same person into the district of Gâtinais, of Paris.[6] At that period, saffron was one of the productions of Cy with which island France was then, through the princes of Lusi particularly related.

During the middle ages, the saffron cultivated at San Gemigna Tuscany was an important article of exportation to Genoa.[7] Th Aquila in the kingdom of Naples was also famous, and was distinguished in price-lists at the beginning of the present century. growing of saffron in Sicily which was noticed even by Colum carried on to the present day, but the quantity produced is insuf even for home consumption.[9] In Germany and Switzerland, wh more rigorous climate must have increased the difficulties of cultiv the production of saffron was an object of industry in many local

The saffron crocus is said to have been introduced into En during the reign of Edward III. (A.D. 1327–1377).[11] Two cen

[1] *Canticles*, ch. iv. 14.

[2] Lassen, *Indische Alterthumskunde*, iii. (1857) 52.

[3] Istachri, *Buch der Länder*, übersetzt von Mordtmann, 87. 93. 124. 126; Edrisi, *Géographie*, trad. par Jaubert, 168. 192.

[4] Bretschneider, *Chinese Botanical Works*, Foochow, 1870. 15.

[5] *Le Calendrier de Cordoue de l'année* 961, Leyde, 1873. 33. 109.

[6] Conrad et Waldmann, *Traité du Safran du Gâtinais*, Paris, 1846.

[7] De Mas Latrie, *Hist. de l'île* iii. 498.

[8] Bourquelot, *Foires de la* Mém. de l'Acad. des inscript. et de l'Institut, v. (1865) 286.

[9] Inzenga, in *Annali di Agricoltura liana*, i. (1851) 51.

[10] Tragus, *De Stirpium*, etc. 1552. Ochs, *Geschichte der Stadt und L Basel*, iii. (1819) 189.

[11] Morant, *Hist. and Antiq. of E* (1768) 545.

ears that English saffron was even exported to the Continent,
ced list of the spices sold by the apothecaries of the north
.D. 1565–1570, mention is made of three sorts of saffron, of
ren d'Engleterre" is the most valuable.[1]
beginning of the last century (1723–28), the cultivation of
carried on in what is described by a contemporary writer[2]
at large tract of ground that lies between Saffron Walden
idge, in a circle of about 10 miles diameter." The same
rks that saffron was formerly grown in several other counties
The cultivation of the crocus about Saffron Walden, which
activity when Norden[3] wrote in 1594, had ceased in 1768,
Cambridge at nearly the same time.[4] Yet the culture must
ed in a few localities, for in the early part of the present
little English saffron was still brought every year from
hire to London, and sold as a choice drug to those who were
ay a high price for it.
was employed in ancient times to a far greater extent than
nt day. It entered into all sorts of medicines, both internal
l; and it was in common use as a colouring and flavouring
f various dishes for the table. The drug, from its inevitable
as been liable to sophistication from the earliest times.
orides and Pliny refer to the frauds practised on it, the latter
"*adulteratur nihil æquè.*"
the middle ages, the severest enactments were not only
were actually carried into effect, against those who were
phisticating saffron, or even of possessing the article in
ted state. Thus at Pisa in A.D. 1305, the *fundacarii*, or
the public warehouses, were required by oath and heavy
o denounce the owners of any falsified saffron con-
heir custody.[5] The Pepperers of London about the same
also held responsible to check dishonest tampering with

ce, an edict of Henry II., of 18 March, 1550, recites the
derived from the cultivation of saffron in many parts of the
nd enacts the confiscation and burning of the drug when
l corporal punishment of offenders.[7]
horities in Germany were far more severe. A *Safranschau*
pection) was established at Nuremberg in 1441, in which
of saffron was publicly burnt at the Schönen Brunnen in
In 1444, Jobst Findeker was burnt together with his
saffron!—And in 1456, Hans Kölbele, Lienhart Frey and a
plicated in falsifying saffron, were buried alive. The
was still in vigour as late as 1591; but new regulations

sorts are "*Safren Calulome*"
ort." *Archives générales du*
quoted by Dorvault, *Revue*
de 1858. p. 58.
Phil. Trans. Nov. 1728. 566.
of Essex, Camden Society,

o. cit.: Lysons, *Magna Bri-*
pt. i. (1808) 36. Lysons records
that at Fulbourn, a village near Cambridge, there had been no *tithe of saffron* since 1774.

[5] Bonaini, *Statuti inediti della città di Pisa dal xii. al xiv. secolo*, iii. (1857) 101.

[6] Riley, *Memorials of London and London Life in the 13th, 14th, and 15th centuries*, 1868. 120.

[7] De la Mare, *Traité de la Police*, Paris, iii. (1719) 428.

for the inspection of saffron were passed in 1613.[1] There wa the same city a *Gewürzschau*, or Spice-inspection, from 1441 to

Description—The flower of the saffron crocus has a style inches long, which in its lower portion is colourless and include the tube of the perianth. In its upper part it becomes yel divides into three tubular, filiform, orange-red stigmas, each a inch in length. The stigmas expand towards their ends, tube of which they consist, is toothed at the edge and slit on i side. The stigma is the only part officinal, and alone is rich in c matter.

Commercial saffron (*Hay Saffron* of the druggists) is a loose thread-like stigmas, which when unbroken are united in three upper extremity of the yellow style. It is unctuous to the touc and flexible; of a deep orange-red, peculiar aromatic smell, an and rather pungent taste. It is hygroscopic and not easily pul it loses by drying at 100° C. about 12 per cent. of moisture v quickly reabsorbs.[2]

The colouring power of saffron is very remarkable: we hav that a single grain rubbed to fine powder with a little sugar, will a distinct tint of yellow to 700,000 grains (10 gallons) of water.

Microscopic Structure—The tissue of the stigma consists thin, sinuous, closely-felted, thread-shaped cells, and small spiral The yellow colouring matter penetrates the whole, and is partly de in granules. The microscope likewise exhibits oil-drops, and lumps probably of a solid fat. Large isolated pollen grains a present.

Chemical Composition—The splendid colouring matter of has long been known as *Polychroit*; but in 1851, Quadrat, who in some fresh researches on the drug, gave it the name of *Cr* was also adopted in 1858 by Rochleder.[3] The experiments of V 1867[4] have shown:—

1. That this substance (*Polychroit, Crocin* of Rochleder) is a glucoside which by the action of acids, splits into sugar, vol and a new colouring matter.

2. That saffron contains only a minute quantity of ready essential oil and sugar.

3. That this free essential oil is probably identical with tha is produced in the decomposition of polychroit.

4. That polychroit as hitherto prepared, has always con certain proportion of the new colouring matter produced by position.

For the natural glucoside, Weiss retains the name of *P* while the new colouring matter which results from its decompos an acid, he terms *Crocin*. It agrees with the *Crocetin* of Rochled

Polychroit was prepared by Weiss in the following manner:

[1] J. F. Roth, *Geschichte des Nürnbergischen Handels*, 1800-1802, iv. 221.

[2] Eight lots of saffron weighing *in toto* 61 lb., dried at various times during the course of nine years, lost 7 lb. 2¼ oz., *i.e.* 11·7 per cent.—(Laboratory records of Messrs. Allen & Hanburys, Plough Court, Street.)

[3] Gmelin, *Chemistry*, xvi. (1864

[4] Wiggers and Husemann, *J* for 1868. 35.

s treated with ether, by which fat, wax, and essential oil were removed; l it was then exhausted with water. From the aqueous solution, mmy matters and some inorganic salts were precipitated by strong ohol. After the separation of these substances, polychroit was ecipitated by addition of ether. Thus obtained, it is an orange-red, icid, deliquescent substance, which, dried over sulphuric acid, becomes ttle and of a fine ruby colour. It has a sweetish taste but is devoid odour, readily soluble in spirit of wine or water, and sparingly in solute alcohol. By dilute acids, it is decomposed into *Crocin*, sugar, d an aromatic volatile oil having the smell of saffron. Weiss gives e following formula for this decomposition:—

$$\underset{\text{polychroit}}{C^{48}H^{60}O^{18}} + H^2O = \underset{\text{crocin}}{2(C^{16}H^{18}O^6)} + \underset{\text{essential oil}}{C^{10}H^{14}O} + \underset{\text{sugar}}{C^6H^{12}O^6}$$

Crocin is a red powder, insoluble in ether, easily soluble in alcohol, l precipitable from this solution on addition of ether. It is only ghtly soluble in water, but freely in an alkaline solution, from which acid precipitates it in purple-red flocks. Strong sulphuric and nitric ds occasion the same colours as with polychroit; the former producing p blue, changing to violet and brown, and the latter green, yellow, finally brown. It is remarkable that hydrocarbons of the benzol s do not dissolve the colouring matter of saffron.

The oil obtained by decomposing crocin is heavier than water; it s at about 209° C., and is easily altered,—even by water. It is bably identical with the volatile oil obtainable to the extent of one cent. from the drug itself, and to which its odour is due.

Saffron contains sugar (glucose ?), besides that obtained by the decomtion of polychroit. It leaves after incineration 5 to 6 per cent. of ash.

Production and Commerce—In France, the flowers are collected ie end of September or in the beginning of October. The stigmas quickly taken out, and immediately dried on sieves over a gentle fire, which they are exposed for only half an hour. According to iesnil[1] 7000 to 8000 flowers are required for yielding 500 grammes oz.) of fresh saffron, which by drying is reduced to 100 grammes.

Notwithstanding the high price of saffron, its cultivation is by no is always profitable, from the many difficulties by which it is ded. Besides occasional injury from weather, the bulbs are often ged by parasitic fungi as stated by Duhamel in 1728[2] and again by agne in 1848.[3]

he most considerable quantity of saffron is now produced in Lower gon, Murcia and La Mancha in Spain, and brought into commerce licante and *Valencia Saffron*. The quantity of saffron exported Spain in 1864 was valued at £190,062; in 1865, £135,316; in £47,083. The drug was chiefly exported to France.[4]

rench saffron, which enjoys a better reputation for purity than the sh, is cultivated in the arrondissement of Pithiviers-en-Gâtinais, e department of the Loiret, which district annually furnishes a

[1] *Bulletin de la Société impériale d'acclimation*, Avril, 1869.

[2] *Mém. de l'Acad. des Sciences*, 1728. p.

[3] *Etude micrographique de la maladie du Safran, connu sous le nom de tacon.*

[4] *Statistical Tables relating to Foreign Countries* (Blue Book), 1870. 286. 289.

quantity valued at 1,500,000 (£60,000) to 1,800,000 francs.[1] The cultivation is carried on by small peasant-proprietors.

In Austria, Maissau, north-east of Krems on the Danube, still produces excellent saffron though only to a very small extent; the district was formerly celebrated for the drug. Saffron is produced in considerable quantity in Ghayn, an elevated mountain region separating Western Afghanistan from Persia.[2] A very little is collected at Pampur in Kashmír, under heavy imposts of the Maharaja.[3] Saffron is also cultivated in some districts of China. Finally, the cultivation has been introduced into the United States, and a little saffron is collected by the German inhabitants of Lancaster County, Pennsylvania.[4] But in almost all countries the cultivation of saffron is on the decline, and in very many districts has altogether ceased.

The imports of saffron into the United Kingdom amounted in 1870 to 43,950 lb., valued at £95,690. The article is largely exported to India, but there are no general statistics to show the amount. Bombay imported in the year 1872–73, 21,994 lb., value £35,115.[5]

Uses— Saffron is of no value for any medicinal effects, and retains a place in the pharmacopœia solely on the ground of its utility as a colouring agent. A peculiar preference for it as a condiment exists in various countries, but especially in Austria, Germany and some districts of Switzerland. This predilection prevails even in England,—at least in Cornwall, where the use of saffron for colouring cakes is still common. Saffron is largely used by the natives of India in religious rites, in medicine and for the colouring and flavouring of food.

As a dye-stuff saffron is no longer employed, at least in this country, its use having been superseded by less costly substances.

Adulteration—Saffron is often adulterated, but the frauds practised on it are not difficult of detection. Sometimes the falsification consists in the addition of florets of *Calendula* dyed with logwood, or of safflower, or the *stamens* of the saffron crocus, any of which may be detected if a small pinch of the drug be dropped on the surface of warm water, when the peculiar form of the saffron stigma will at once become evident.

Another adulteration of late much practised, and not always easy to detect by the eye, consists in coating genuine saffron with carbonate of lime, previously tinged orange-red. If a few shreds of such saffron be placed on the surface of water in a wineglass and gently stirred, the water will *immediately* become turbid, and the carbonate of lime will detach itself as a white powder and subside. Saffron thus adulterated will *freely effervesce* when dilute hydrochloric acid is dropped upon it. We have examined Alicante Saffron the weight of which had been increased more than 20 per cent. by this fraudulent admixture. The earthy matter employed in sophisticating saffron is said to be sometimes emery powder, rendered adherent by honey. We have found that adulterated with carbonate of lime to leave from 12 to 28 per cent. of ash.

[1] Dumesnil, l. c.
[2] Bellew, *From the Indus to the Tigris*, Lond. 1874. 304.
[3] Powell, *Punjab Products*, i. (1868) 449.
[4] *Proc. of the American Pharm. Ass.* 1866. 254.
[5] *Annual Statement of the Trade and Navigation of the Presidency of Bombay* for 1872–73. pt. ii. 30.

PALMÆ.

SEMEN ARECÆ.

ces Areca vel Betel; Areca Nuts, Betel Nuts; F. *Semence ou Noix d'Arec;* G. *Arekanüsse, Betelnüsse.*

Botanical Origin—*Areca Catechu* L., a most elegant palm, with a ght smooth trunk, 40 to 50 feet high and about 20 inches in circum- ce. The inflorescence is arranged on a branching spadix, with the flowers on its upper portion and the female near its base. The is cultivated in the Malayan Archipelago, the warmer parts of the n Peninsula, Ceylon, Indo-China and the Philippines. It is pro- y indigenous to the first-named region.

History—The Areca palm is mentioned in the Sanskrit writings as *ca.* It is called in Chinese *Pin-lang*, a name apparently derived *Pinang*, a designation for the tree in the Malay Islands, whence the ese anciently derived their supply of the seeds. The oldest Chinese to mention the *pin-lang*, is the *San-fu-huang-tu*, a description of g-an, the capital of the Emperor Wu-ti, B.C. 140–86. It is there d that after the conquest of Yunnan, B.C. 111, some remarkable trees plants of the south were taken to the capital, and among them more 100 *pin-lang*, which were planted in the imperial gardens. Bret- eider,[1] to whose researches we are indebted for this information, cites al other Chinese works, from the first century downwards, showing areca nuts were brought from the then unsubdued provinces of hern China, the Malayan Archipelago and India. The custom of nting areca nut to a guest, is alluded to in a work of the 4th ry.

he Arabian writers were well acquainted with the areca nut, which called *Fófal*, and with the Indian custom of masticating it with lime. areca nut though held in great estimation among Asiatics as a masti- y, and supposed to strengthen the gums, sweeten the breath and ove digestion, has not until recently been regarded as possessing any cular medicinal powers beyond those of a mild astringent. It has been administered as a vermifuge to dogs, and in India and China ven with the same intent to the human subject. Some success- rials recently made of it for the expulsion of tapeworm, have led to ing included in the *Additions to the British Pharmacopœia of 1867*, ished in 1874.

Description—The areca palm produces a smooth ovoid fruit, of the of a small hen's egg, slightly pointed at its upper end, and crowned the remains of the stigmas. Its exterior consists of a thick pericarp, st fleshy, but when quite mature, composed of fine stringy fibres ing lengthwise, with much coarser ones below them. This fibrous is consolidated into a thin crustaceous shell or endocarp, which unds the solitary seed. The latter has the shape of a very short led cone, scarcely an inch in height; it is depressed at the centre of ase, and has frequently a tuft of fibres on one side of the depression, ting its connexion with the pericarp. The testa, which seems to rtially adherent to the endocarp, is obscurely defined, and insepa-

[1] *On the study of Chinese botanical works*, Foochow, 1870. 27.

evident in polarized light. The brown tissue which runs i
men is of loose texture, and resembles the corresponding st
nutmeg. The thin walls of its cells are marked with fine spir
and in this tissue, as well as on the brown surface of the s
spiral vessels are scattered. All the brown cells assume a
moistened with caustic lye, and a dingy green with ferric ch

Chemical Composition—We have exhausted the po
seeds, previously dried at 100° C., with ether; and thereb
colourless solution, which after evaporation left an oily liqui
on cooling. This fatty matter, representing 14 per cent.
was thoroughly crystalline and melted at 39° C. By sapon
obtained from it a crystalline fatty acid fusing at 41° C.,
consequently be a mixture of lauric and myristic acids. S
fatty matter was boiled with water: the water on evaporat
an extremely small trace of tannin but no crystals, which h
been present should have been left.

The powdered seeds which had been treated with ethe
exhausted by cold spirit of wine (·832), which afforded 14·
(reckoned on the original seeds) of a red amorphous *ta*
which after drying, proved to be but little soluble in water, v
or boiling. Submitted to destructive distillation, it afforded *J*
Its aqueous solution is not altered by ferrous sulphate, unle
is added, when it assumes a violet hue, with separation o
dark purplish precipitate. On addition of a ferric salt in m
tity to the aqueous solution of the tannic matter, a fine g
produced, quickly turning brown by a further addition of t
violet by an alkali. An abundant dark precipitate is also fo

The seeds having been exhausted by both ether and spi

Tauclea, and rather to be considered a kind of tannic matter of the nature f *Ratanhia-red* or *Cinchona-red.*

By incinerating the powdered seeds, 2·26 per cent. were obtained of brown ash, which besides peroxide of iron, contained phosphate of iagnesium.

Commerce—Areca nuts are sold in India both in the husk (peri-arp) and without it, and the two sorts are enumerated in the Customs leturns under distinct heads. Their widespread consumption in the 'ast gives rise to an enormous trade, of which some notion may be ormed by a consideration of the few statistics bearing upon it which are ccessible.

Thus, Ceylon exported of areca nuts in the year 1871, 66,543 cwt., alue £62,593; in 1872, 71,715 cwt.,—the latter quantity entirely to ndia.[1] The Madras Presidency largely trades in the same commodity. n the year 1872–73, there were shipped thence to Bombay, 43,958 cwt., esides about two millions of the entire fruit.[2] An extensive traffic in reca nuts is carried on at Singapore and especially in Sumatra.

Uses—Powdered areca nut may be given for the expulsion of tape-orm in the dose of 4 to 6 drachms, taken in milk. The remedy hould be administered to the patient after a fast of about twelve hours; ome recommend the previous exhibition of a purgative. It is said to e efficacious against *lumbricus* as well as *tænia.*

The charcoal afforded by burning areca nuts in a close vessel is sold s a tooth powder; but except greater density, it possesses no advantage ver the charcoal from ordinary wood.

As a masticatory, areca nut is chewed with a little lime and a leaf of e Betel Pepper, *Piper Betle* L. The nut for this purpose is used in a oung and tender state, or is prepared by boiling in water; it is some-mes combined with aromatics, as camphor or cardamom.

SANGUIS DRACONIS.

esina Draconis; Dragon's Blood; F. *Sang-dragon;* G. *Drachenblut.*

Botanical Origin—*Calamus Draco* Willd. (*Dæmonorops Draco* rt.)—This is one of the Rotang or Rattan Palms, remarkable for their y long flexible stems, which climb among the branches of trees by ans of spines on the leafstalk. The species under notice, called in lay *Rotang Jernang*, grows in swampy forests of the Residency of embang and in the territory of Jambi, in Eastern Sumatra, and in thern Borneo, which regions furnish the dragon's blood of com-rce. It is said to occur also in Penang and in various islands of the da chain.

History—The substance which is mentioned by Dioscorides under name of Κιννάβαρις, as a costly pigment and medicine brought from ica, and which is also described by Pliny who distinguished it from ium, was certainly the resin called *Dragon's Blood.* It was not

[1] Ceylon Blue Books for 1871 and 1872.

[2] From the returns quoted at p. 514, note 6.

The fact we wish to prove is corroborated by the accou
commercial intercourse between the Chinese and Arabs re
lished by Bretschneider.[2] From the 10th to the 15th centur
carried on between these nations a trade, the objects of whi
only the productions of the Arabian Gulf and countries fu
but also those of the Indian Archipelago. One of the is
which the Arabs and Persians carried on a great commerce w
whence they obtained the precious camphor so much val
Chinese, but not, so far as appears, the resin dragon's bl
the productions brought from Arabia, they are enumerated a
Olibanum, Liquid Storax, Myrrh, and *Dragon's Blood*, beside
articles not yet determined. It is worthy of remark that t
are still the principal consumers of dragon's blood, though li
of mankind, they have to content themselves with the plent
Sumatra and Borneo, instead of the more ancient sort p
Socotra.

The first clear account of the production of the resin i
that given by Rumphius, who in his *Herbarium Amboinens*
the process by which it is collected at Palembang.

Production—The fruit of *Calamus Draco,* which is p
panicles in great profusion, is globose and of the size of a la
clothed with smooth downward-overlapping scales. These
sub-quadrangular, thick and shell-like, marked with a l
furrow; the largest, which are found towards the middle o
are 2 lines long by 3 broad. At maturity, the fruit is cover
exudation of red resin, which encrusts it so abundantly that
the scales can hardly be seen.

The resin, which is naturally friable, is collected by ga
fruits and shaking or beating them in a sack by which

f other substances by way of adulteration. The foregoing is the account f the manufacture of the drug given by Blume.[1]

Description—Dragon's Blood is found in commerce chiefly in two orms, known respectively as *Reed* and *Lump*.

1. ***Reed Dragon's Blood*** (Dragon's Blood in sticks, *Sanguis raconis in baculis*). Some of fine quality purchased in London in 842, is in sticks 13 to 14 inches in length, and ¾ to 1 inch in iameter, neatly wrapped in palm-leaf, secured by 8 or 9 transverse ands of some flexible grass. The average weight of each stick, including ie enveloping leaf, is five ounces. The resin has evidently been rapped up while soft, as the sticks are furrowed longitudinally by ressure of the surrounding leaf. The smooth surface is of an intense lackish-brown; when seen in thin splinters, the resin appears transarent, and of a pure and brilliant crimson. The fractured surface looks esinous and rough, is a little porous, and contains numerous particles f the scales of the fruit. Rubbed on paper, it leaves a red mark, of not ery splendid tint. Heated with spirit, it left 20 per cent. of pulverunt residue consisting chiefly of vegetable matter. Sticks of smaller ze are more common.

2. ***Lump Dragon's Blood*** (*Sanguis draconis in massis*) is imported i large rectangular blocks, or irregular masses. From the fine *Reed Dragon's Blood*, just described, it differs in containing a larger proporon of remains of the fruit, including numerous entire scales. Hence has a coarser fracture, and the fractured surface is less intense in int. Its taste is slightly acrid. Exhausted with spirit of wine it leaves residue amounting in the specimen we tested, to 27 per cent.

Dragon's blood is abundantly soluble in the usual solvents of resins, namely, the alcohols (even in dilute spirit of wine), benzol, chloroorm, bisulphide of carbon and the oxygenated essential oils, as that of loves. The residue left after the evaporation of these liquids, is amorhous and of the original fine red colour. The drug is likewise dissolved y glacial acetic acid, as well as by caustic soda; the latter solution, on ddition of an excess of acid, yields a dingy brown, jelly-like precipitate hich on drying turns dark red like the original drug. In ether, dragon's lood is sparingly soluble and still less so in oil of turpentine; but in ie most volatile portions of petroleum, the so-called petroleum ether, we nd it to be entirely insoluble. It has a slightly sweetish and somewhat rid taste; melts at about 120° C., evolving the aromatic but irritating mes of benzoic acid; boiled with water, the resin becomes soft and rtially liquid.

Chemical Composition—Dragon's blood is a peculiar resin, which cording to Johnston,[2] answers to the formula $C^{20}H^{20}O^{4}$. By heating it d condensing the vapour, an aqueous acid liquid is obtained, together th a heavy oily portion of a pungent burning taste, and crystals of nzoic acid. The composition of these products has not yet been roughly ascertained, but the presence of acetone, *Toluol*, $C^{7}H^{8}$ (the *acyl* of Gérhard and Boudault, 1844) and *Styrol*, $C^{8}H^{8}$ (*Draconyl*), has en pointed out,[3]—the latter perhaps due to the existence in the drug

[1] *Rumphia*, iii. (1847) 9. tab. 131. 132.
[2] *Phil. Trans.* 1839. 134; 1840. 384.
[3] Gmelin, *Chemistry*, xvii. (1866) 387.

of metastyrol (p. 244), as suggested by Kovalewsky.[1] Both these hydrocarbons are *lighter* than water; yet we find that the above oily portion yielded by dry distillation, sinks in water, a circumstance possibly occasioned by the presence of benzoic alcohol, C^7H^8O.

As benzoic acid is freely soluble in petroleum ether, it ought to be removed from the drug by that solvent: on making the experiment, we got traces of an amorphous red matter, a little of an oily liquid, but nothing crystalline. As to the watery liquid, it assumes a blue colour on addition of perchloride of iron, whence it would appear to contain phenol or pyrogallol, rather than pyrocatechin (p. 172).

By boiling dragon's blood with nitric acid, benzoic, nitro-benzoic and oxalic acids are chiefly obtained, and only very little picric acid. *Hlasiwetz* and *Barth* melted the drug with caustic potash and found among the products thus formed, phloroglucin (p. 172), para-oxybenzoic, protocatechuic and oxalic acids, as well as several acids of the fatty series. Benzoin yields similar products.

Commerce—Dragon's blood is shipped from Singapore and Batavia. Large quantities are annually exported from Banjarmasin in Borneo to these places and to China.[2]

Uses—In medicine, only as the colouring agent of plasters and tooth powders: in the arts, for varnish.

Adulteration—Dragon's blood varies exceedingly in quality,[3] of which the principal criterion regarded by the dealers, is *colour*. Some of the inferior sorts make only a dull brick-red mark when rubbed on paper, and have an earthy-looking fracture. The sticks moreover do not take the impression of the enveloping leaf, as when they are more purely resinous. A sample of inferior Reed Dragon's Blood afforded us 40 per cent. of matter, insoluble in spirit of wine.

Other sorts of Dragon's Blood.

Dragon's Blood of Socotra—We have already stated (p. 609) that the *Cinnabar* mentioned by Dioscorides was brought from Africa. That the term really designated dragon's blood, seems evident from the fact that the author of the Periplus of the Erythrean Sea,[4] written *circa* A.D. 54–68, names it (Κιννάβαρι) as a production of the island of Dioscorida, the ancient name of Socotra.

The Arabians, as Abu Hanifa and Ibn Baytar,[5] describe dragon's blood as brought from Socotra, giving to the drug the very name by which it is known to the Arabs at the present day, namely, *Dam-al-akhawein*. Barbosa (1514) as well as Giovanni di Barros[6] mention it as a production of the island; and in our own times it has been noticed by Wellstead,[7] Vaughan,[8] and Von Kremer.[9] It is now but little collected.

[1] Gmelin, *Chemistry*, xvii. 388; also *Ann. d. Chemie*, cxx. (1861) 68.

[2] Low, *Sarawak, its inhabitants and productions*, 1848. 43.

[3] The present price, £3 to £11 per cwt., sufficiently indicates this.

[4] *Voyage of Nearchus and Periplus of the Erythrean Sea*, translated by Vincent, Oxford, 1809. 90.

[5] Sontheimer's ed. i. 104. 426. ii. 117.

[6] *L'Asia*. sec. deca, Venet. 1561. p. 14 a.

[7] *Travels in Arabia*, Lond. 1838. ii. 48.

[8] *Pharm. Journ.* xii. (1853) 385.

[9] *Aegypten*, Leipzig, 1863.

aughan states, as well as Von Wrede, that the tree is found in adramaut and on the east coast of Africa. Species of *Dracæna* cur in these regions, but of the botany of Socotra itself, nothing known.

The *Drop Dragon's Blood*, of which small parcels imported from ombay or Zanzibar, occasionally appear in the London market, is owever this drug. It is in small tears and fragments, seldom exceeding inch in length, has a clean, glassy fracture, and in thin pieces is transrent and of a splendid ruby colour. From Sumatran dragon's blood, may be distinguished by not containing the little shell-like scales, nstantly present in that drug, and by not evolving when heated on e point of a knife, the irritating fumes of benzoic acid.

Dragon's Blood of the Canary Islands—This substance is afforded *Dracæna Draco* L., a liliaceous tree[1] resembling a *Yucca*, of which e famous specimen at Orotava in Teneriffe has often been described on count of its gigantic dimensions and venerable age.[2]

On the exploration of Madeira and Porto Santo in the 15th century, agon's blood was one of the valued productions collected by the yagers, and is named as such by Alvise da ca da Mosto in 1454.[3] It also mentioned by the German physician, Hieronymus Münzer, who sited Lisbon about 1494.[4]

The tree yields the resin after incisions are made in its stem; but so r as we know, the exudation has never formed a regular and ordinary ticle of commerce with Europe. It has been found in the sepulchral ves of the aboriginal inhabitants.

The name *Dragon's Blood* has also been applied to an exudation tained from the West Indian *Pterocarpus Draco* L., and to that of *oton Draco* Schlecht.; but the latter according to Henkel is of the ture of kino, and neither substance is met with in European commerce.

AROIDEÆ.

RHIZOMA CALAMI AROMATICI.

dix Calami aromatici, Radix Acori; Sweet Flag Root; F. *Acore odorant ou vrai, Roseau aromatique;* G. *Kalmus.*

Botanical Origin—*Acorus Calamus* L., an aromatic, flag-like plant, wing on the margins of streams, swamps and lakes, from the coasts he Black Sea, through Southern Siberia, Central Asia and India, as as Amurland, Northern China and Japan; indigenous also to North erica. It is now established as a wild plant in the greater part of ope, reaching as far north as Scotland, Scandinavia and Northern sia; and is cultivated to a small extent in Burma and Ceylon.

[1] Histological observations on the structure stem, accompanied by excellent figures, e found in a memoir by Rauwenhoff *rage tot de kennis van Dracæna Draco* 5. tabb. 5) in the *Verhand d. Kon. r. Wetensch., afd. Natuurk.* x. 1863.

[2] It was destroyed in 1867 by a hurricane.

[3] Ramusio, *Raccolta delle Navigationi et Viaggi*, Venet. i. 97.

[4] Kunstmann, *Abhandlungen der Baierischen Akademie der Wissenschaften*, vii. (1855) 342. et seq.

Regarding the introduction of *Acorus Calamus* into Western Europe, Clusius[1] relates that he first received a living plant in 1574, sent from the lake Apollonia near Brussa in Asia Minor. Camerarius,[2] writing in 1588, speaks of it as introduced some years previously, and then plentiful in Germany, which seems to show a rapid propagation. Gerarde at the close of the century, looked upon *Acorus* as an Eastern plant, which he says, is grown in many English gardens, and might hence be fitly called the "*Sweet Garden Flag.*" Berlu[3] in 1724, observes of the root, that—"*it is brought in quantities from Germany:*" hence we may infer that it was not then collected in England, as we know it was at a later period.[4]

History—Sweet Flag root has been from the earliest times a favourite medicine of the natives of India, in which country it is sold in every bazaar. Ainslie[5] asserts that it is reckoned so valuable in the bowel complaints of children, that there is a penalty incurred by any druggist who will not open his door in the middle of the night to sell it, if demanded!

The descriptions of *Acoron*, a plant of Colchis, Galatia, Pontus and Crete, given by Dioscorides and Pliny, certainly refer to this drug. We think that the Κάλαμος ἀρωματικος of Dioscorides, which he states to grow in India, is the same, though Royle regards it as an *Andropogon*. The Κάλαμος of Theophrastus, and the *Calamus* of the English Bible[6] are considered by some authors to refer to the Sweet Flag.

Celsus in the first century, mentioned *Calamus Alexandrinus*, the drug being probably then brought from India by way of the Red Sea. We know by the testimony of Amatus Lusitanus[7] that in the 16th century, it used to be so imported into Venice. Rheede[8] moreover described and figured *Acorus Calamus* as an Indian plant under the name *Vacha*, which it still bears on the Malabar Coast.

Murray[9] states expressly that in his time (1790), Asiatic calamus was still met with in the pharmacies of Continental Europe, but that it had mostly been replaced by the home-grown drug. At the present time, the *Calamus aromaticus* of commerce is European; in all essential characters it agrees with that of India, a package of which is now and then offered in the London drug sales.

Collection—The London market is supplied from Germany, whither the drug is brought we believe, from Southern Russia. It is no longer collected in England,—at least in quantity, though it used to be gathered some years ago in Norfolk.

Description — The rootstock of sweet flag occurs in somewhat tortuous, subcylindrical or flattened pieces, a few inches long, and from ½ to 1 inch in greatest diameter. Each piece is obscurely marked on

[1] *Rariorum Stirpium Historia*, Antv. 1576. 520.

[2] *Hortus medicus et philosophicus*, Francof., 1588. 5.

[3] *Treasury of Drugs*, ed. 2. 1724. 115.

[4] See also Trimen in *Journ. of Botany*, ix. (1871) 163.

[5] *Mat. Med. of Hindoostan*, Madras, 1813 54.

[6] Exod. xxx. 23.; Cant. iv. 14.; Isai. xxvii. 19.—See also page 650, footnote 1

[7] *In Dioscor. de Mat. Med. Enarrationes*, Argent. 1554. 33.

[8] *Hortus Malabar.* xi. (1692) tab. 48. fig.

[9] *Apparatus Medicaminum*, v. 40.

surface with the scars, often hairy, of leaves, and on the under gzag line of little, elevated, dot-like rings,—the scars of roots. ıtock is usually rough and shrunken, varying in colour from vn to orange-brown, breaking easily with a short corky fracture, biting a pale brown spongy interior. The odour is aromatic able; the taste, bitterish and pungent.

resh rootstock is brownish-red or greenish, white or reddish nd of a spongy texture. Its transverse section is tolerably a fine line (medullary sheath) separates the outer tissue from er central part, the diameter of which is twice or three times of the former.

oscopic Structure—The outermost layer is made up of epiblema-cells or of a brown corky tissue, the latter occurring arts free from leaf-scars. The prevailing tissue, both of the l the central part, consists of uniform nearly globular cells, by numerous vascular bundles, especially at the boundary line y sheath). Besides them, the rootstock like that of many er plants, exhibits a large number of intercellular holes. These or more correctly water-holes, are somewhat longitudinally so as to form a kind of net-work[1] imparting a spongy con- o the fresh rootstock. At certain places, where the series of one another, especially in the outer part, there are single cells, ı essential oil,[2] which may be made very conspicuous by adding ıs dilute potash or perchloride of iron. The other cells are th small starch granules; a little mucilage and tannic matter th in the exterior coat.

ıical Composition—The dried rhizome yielded us 1·3 per yellowish neutral essential oil of agreeable odour, which in a f 50 mm. long, deviates the ray of polarized light 13·8° to the ccording to Kurbatow (1873) this oil contains a hydrocarbon, oiling at 159°C., and forming a crystalline compound with HCl, her hydrocarbon boiling at 255–258° C., affording no crystal- drochloric compound. The crude oil acquires a dark brownish ı addition of perchloride of iron, but is not at all soluble in ted potash solution; it mixes with spirit of wine, and with 4 ımes of bisulphide of carbon, yet not so as to form with the ear solution.

ıitter principle, *Acorin*, was isolated by Faust in 1867, as a brownish glucoside, containing nitrogen, soluble both in ether ohol, but neither in benzol nor in water. In order to obtain tance, we precipitated the decoction of 10 ℔. of the drug by tannic acid, and followed the method commonly practised in ıration of bitter principles. By finally exhausting the residue oroform, we succeeded in obtaining a very bitter, perfectly e body, but in so minute a quantity, that we were unable to e its nature.

oniliform or stellate arrangement observed by Albertus Magnus 1280), who says:—(Calamus —nascitur in India et Ethiopia et habet interius ex parte con- m subtilem, *sicut tela sunt aranearum*."—*De Vegetabilibus*, Jessen's ed. 1867. 376.

[2] Hence the practice of *peeling* the rhizome which prevails in some parts of the Continent ought to be abandoned.

Uses—Sweet Flag is an aromatic stimulant and tonic, now rarely used in regular medicine. It is sold by the herbalists for flavouring beer, and for masticating to clear the voice. It is said to be also used by snuff manufacturers.

Adulteration—The rhizome of the Yellow Flag, *Iris Pseudacorus* L. is occasionally mixed with that of the Sweet Flag, from which it may be distinguished by its want of aroma, astringent taste, dark colour, and dissimilar structure.

LILIACEÆ.

ALOË.

Aloes; F. *Aloès ou Suc d'Aloès*; G. *Aloë*.

Botanical Origin—Several species of *Aloë*[1] furnish a bitter juice which when inspissated, forms this drug. These plants are for the most part natives of arid, sunny places in Southern and Eastern Africa, whence a few species have been introduced into Northern Africa, Spain, and the East and West Indies.

The aloes are succulent plants of liliaceous habit, with persistent fleshy leaves, usually prickly at the margin, and erect spikes of yellow or red flowers. Many are stemless; others produce stems some feet in height, which are woody and branching. In the remote districts of Namaqua Land and Damara Land in Western South Africa, and in the Transkei Territory and Northern Natal to the eastward, aloes have been discovered which attain 30 to 60 feet in height, with stems as much as 30 feet in circumference.[2] The following species may be named with more or less of certainty as yielding the drug:—

Aloë Socotrina Lam. (*A. vera* Miller), native of the southern shores of the Red Sea and Indian Ocean, Socotra, and Zanzibar (?). It is the source of the *Socotrine* and *Moka Aloes*. *A. officinalis* Forsk. and *A. rubescens* DC. are considered to be varieties of this plant. *A. Abyssinica* Lam. may probably contribute to the aloes shipped from the Red Sea.

A. vulgaris Lam. (*A. perfoliata*, var. *π. vera* Linn., *A. Barbadensis* Mill.), a plant of India and of Eastern and Northern Africa, now found also on the shores of Southern Spain, Sicily, Greece, and the Canaries; introduced into the West Indies, or as some think, possibly a true native. It affords *Barbados* and *Curaçao Aloes*. *A. indica* Royle,[3] a plant of the North-west Provinces of India, common in Indian gardens, appears to be a slight variety of *A. vulgaris* Lam. *A. litoralis* König, said to grow in abundance at Cape Comorin, is unknown to us. Dr. Bidie suggests that

[1] Apparently derived from the Syriac *Alwai*. It is important to bear in mind that the word *Aloes* or *Lign Aloës*, in Latin *Lignum aloës*, is used in the Bible and in many ancient writings, to designate a substance totally distinct from the modern *Aloes*, namely the resinous wood of *Aquilaria Agallocha* Roxb., a drug which was once generally valued for use as incense, but now esteemed only in the East.

Various species of *Agave*, especially *A. Americana* L., are popularly called aloes. All of them are plants of Mexico, while the true aloes are natives of the old world. Botanically the genus *Agave* differs from *Aloë*, in that the former has the ovary *inferior*, while in the latter it is superior.

[2] Dyer in *Gardeners' Chronicle*, May 2, 1874, with figures.

[3] Dr. Bidie of Madras has kindly sent me a living specimen of this plant.

s a form of the preceding, stunted by a poor saline soil and exposure the sea breeze. Both *A. indica* and *A. litoralis* are named in the *armacopœia of India.*

Aloë ferox L., and hybrids obtained by crossing it with *A. Africana* ll. and *A. spicata* Thunb., *A. perfoliata* Linn. (*quoad* Roxb.) and *linguæformis* are reputed to yield the best *Cape Aloes.*

A. Africana Mill. and its varieties, and *A. plicatilis* Mill. afford extract which Pappe [1] says, is thought to be less powerful.

A. arborescens Mill., *A. Commelini* Willd. and *A. purpurescens* Haw. stated to produce a portion of the *Cape Aloes* of commerce.[2]

History—Aloes was known to the Greeks as a production of the and of Socotra as early as the 4th century B.C., if we might credit a narkable legend thus given in the writings of the Arabian geographer risi.[3] When Alexander had conquered the king of the Persians and fleets had vanquished the islands of India, and he had killed Pour, ıg of the Indies, his master Aristotle recommended him to seek the ınd that produces *Aloes.* So when he had finished his conquests in lia, he returned by way of the Indian Sea into that of Oman, ıquered the isles therein, and arrived at last at Socotra, of which he nired the fertility and the climate. And from the advice which stotle gave him, he determined to remove the original inhabitants to put Greeks in their place, enjoining the latter to preserve carefully plant yielding aloes, on account of its utility, and because that hout it, certain sovereign remedies could not be compounded. He ught also that the trade in and use of this noble drug would be a at advantage for all people. So he took away the original people the island of Socotra, and established in their stead, a colony of ians, who remained under his protection and that of his successors, acquired great riches, until the period when the religion of the ısiah appeared, which religion they embraced. Then they became istians, and so their descendants have remained up to the present (*circa* A.D. 1154).

This curious account, which Yule [4] says is doubtless a fable, but nted to account for facts, is alluded to by the Mahommedan ellers of the 9th century [5] and in the 10th by Masudi,[6] who says in his time aloes was produced only in the island of Socotra, where ıanufacture had been *improved* by Greeks, sent thither by Alexander Great.

Aloes is not mentioned by Theophrastus, but appears to have been known to Celsus, Dioscorides, Pliny and the author of the Periplus ıe Erythrean Sea, as well as to the later Greek and the Arabian icians. From the notices of it in the Anglo-Saxon leech-books. reference to it as one of the drugs recommended to Alfred the

ora Capensis Medica Prodromus, ed. 7. 41.

the above revision of the medicinal of *Aloë*, we have made free use of llon's recent observations on the same , contained in the *Dictionnaire des s Médicales*, iii. 360, also *Journ. de* . v. (1867) 406. We have also had vantage of consulting W. Wilson rs, Esq., F.R.S., whose long familiarity with these plants in cultivation impart great weight to his opinion.

[3] *Géographie d'Edrisi*, traduite par P. A. Jaubert, Paris, i. (1836) 47.

[4] *Marco Polo*, ii. 343.

[5] *Anciennes Relations des Indes et de la Chine de deux Voyageurs Mahometans, qui y allèrent dans le neuvième siècle*, traduites de l'Arabe, Paris, 1718. 113.

[6] Tome iii. 36.—See p. 541, note 4.

Great by the Patriarch of Jerusalem, we may infer that its use was not unknown in Britain as early as the 10th century.[1]

At this period and for long afterwards, the drug was imported into Europe by way of the Red Sea and Alexandria. After the discovery of a route to India by the Cape of Good Hope, the old line of commerce probably began to change.

Thomé Pyres, an apothecary at Cochin, in a letter on Eastern drugs[2] addressed to Manuel, king of Portugal, in 1516, reports that aloes grows in the island of Çacotora, Aden, Cambaya, Valencia of Arragon, and in other parts,—the most esteemed being that of Çacotora, and next it that of Spain; while the drug of Aden and Cambaya is so bad as to be worthless.

In the early part of the 17th century, there was a direct trade in aloes between England and Socotra; and in the records of the East India Company, there are many notices of the drug being bought of the "King of Socotra." Frequently the king's whole stock of aloes is mentioned as having been purchased.[3]

Wellstead, who travelled in Socotra in 1833,[4] says that in old times the aloë was far more largely grown there than at present, and that the walls which enclosed the plantations may still be seen. He adds, that the produce was a monopoly of the Sultan of the island. At the present day, the few productions of Socotra that are exported, are carried by the Arab coasting vessels, coming annually from the Persian Gulf to Zanzibar, at which place they are transhipped for Indian and other ports. Dr. Kirk, who has resided at Zanzibar from 1866 to 1873, informs us that aloes from Socotra arrives in a very soft state packed in goatskins. From these it is transferred to wooden boxes, in which it concretes, and is shipped to Europe and America. To avoid loss, the skins have to be washed; and the aloetic liquor evaporated.

Ligon,[5] who visited the island of Barbados in 1647–50, that is about twenty years after the arrival of the first settlers, speaks of the aloë as if it were indigenous, mentioning also the useful plants which had been introduced. At that period, the settlers knew how to prepare the juice for medicinal use, but had not begun to export it. Barbados aloes was in the drug warehouses of London in 1693.[6]

The manufacture of aloes in the Cape Colony of South Africa was observed by Thunberg in 1773, on the farm of a boer named Peter de Wett, who was the first to prepare the drug in that country.[7] Cape Aloes is enumerated in the stock of a London druggist in 1780, its cost being set down as £10 per cwt. (1*s.* 9½*d.* per ℔.)

A new and distinct sort of aloes, manufactured in the colony of Natal, appeared in English commerce in 1870. It will be described further on.

Structure of the Leaf—The stout fleshy leaves of an aloë have a strong cuticle and thick-walled epidermis. Their interior substance is formed of very loose, large-celled, colourless, mucilaginous pulp

[1] See p. 394, note 1.

[2] *Journ. de Soc. Pharm. Lusit.* ii. (1838) 36.

[3] *Calendar of State Papers*, Colonial Series, East Indies, China and Japan, 1513–1616, Lond. 1862.

[4] *Journ. of the Roy. Geograph. Soc.* v. (1835) 129–229.

[5] *History of Barbados*, Lond. 1673.

[6] Dale, *Pharmacologia* (1693) 361.

[7] Thunberg, *Travels in Europe, Asia and Africa*, ii. 49. 50.

›ying ten times or more the breadth of the layer of small-celled ıchyme containing chlorophyll, which separates the pulp from the le.

'he inner cortical layer contains at its junction with the pulp, ›rous bundles of vessels, which on transverse section, are seen to be ıged at equal distances around the pulp. The inner part of each le consists of delicate, elongated tissue, and several rows of thin-d cells adjoining a remarkable layer of smaller, prismatic, truncated

They are laid quite simply one upon the other and side by side, :herefore bear no resemblance to the system of vessels seen in milky s. These cells in a leaf of *Aloë Socotrina*, examined in the summer, ɔund to be filled with a transparent, yellow, viscid substance, which allizes when a section moistened with glycerin is left for a few

Trécul [1] also found the peculiar cells containing the bitter juice *loë mitræformis*, grown at Paris. He observed that the transverse of these cells sometimes disappear, and then considerable ducts d with the peculiar juice are formed. In southern regions, this ›ss probably goes on to a large extent, thus explaining how the juice undantly obtained without pressure. The remaining portion of the ›al tissue is filled with granules of chlorophyll, and exhibits between ells, groups of needles of calcium oxalate. Similar crystals are also l sparingly in the pulp.

'he transparent pulp-tissue is filled with a viscid, colourless, less mucilage, which after dilution with water is precipitated by ›al acetate of lead, but is not coagulated by boiling even after lation with nitric acid.[2] In an alkaline solution of cupric tartrate, :asions slight reduction on heating. It does not become coloured :posure to the air. The bundles of cells surrounding the vessels, in on the other hand (abundantly in *A. Socotrina* and *A. spicata*, o in *A. vulgaris* and *A. arborescens*) a colourless juice, which when ıed to the air, especially in contact with iron, quickly assumes a violet colour. That the bundles of vessels are the seat of this nogen, is easily seen when a thin section of a fresh aloë-leaf is ›ly exposed to the vapour of ammonia.

he amount of bitter principles in the leaf probably varies with the f the latter and with the season of the year. Haaxman mentions in Curaçao, the maximum is found when the leaves are changing green to brown.

ultivation and Manufacture—In Barbados,[3] where *Aloë vulgaris* stematically cultivated for the production of the drug, the plants et 6 inches apart, in rows which are 1 to 1½ foot asunder, the ıd having been carefully prepared and manured. They are kept from grass and weeds, but yams or pulse are frequently grown ›en them. The plants are always dwarf, never in the least degree ›scent; almost all of those above a year old, bear flowers, which bright yellow, have a beautiful effect. The leaves are 1 to 2 feet

n. *des Sciences Nat.*, Bot., xiv. (1872)

is central pulpy tissue is *quite taste-* l is actually used as food in times of in some parts of India.—Stewart, *Plants*, 1869. 232.

[3] For the particulars we here give respecting Barbados aloes, we have cordially to thank Sir R. Bowcher Clarke, Chief Justice of Barbados, and also Major-General Munro now (1874) stationed at Barbados in command of troops.

they regard as exhausted. The leaves are neither infused nor is any use afterwards made of them except for manure.

When the vessels receiving the juice become filled, tl removed to a cask and reserved for evaporation. This may once, or it may be delayed for weeks or even months, the juic not fermenting or spoiling. The evaporation is generally con copper vessel; at the bottom of this is a large ladle, into impurities sink, and are from time to time removed as the l on. As soon as the inspissation has reached the proper p is determined solely by the experienced eye of the wo thickened juice is poured into large gourds or into boxes, a to harden.

The drug is not always readily saleable in the island, bu bought up by speculators who keep it till there is a deman England. The cultivators are small proprietors, but little ca mind or means, of making experiments to improve the man the drug. It is said however, that occasionally a little al superior kind is made for some special purpose by exposing a shallow vessel to solar heat till completely dry. But suc stated to cost too much time and trouble to be profita manufacture of aloes in the Dutch West Indian island of conducted in the same manner.[2]

The manufacture of aloes in the Cape Colony has been th to us in a letter[3] from Mr. Peter MacOwan of Gill Colleg East:—The operator scratches a shallow dish-shaped hollow ground, spreads therein a goatskin, and then proceeds to arra the margin, a radial series of aloë leaves, the cut ends inwards. Upon this, a second series is piled, and then a t being taken that the ends of each series overhang sufficient

ness. Fresh juice is added to that which has nearly acquired ıhed consistence; the fire is slackened or urged just as it happens, boiling is often interrupted for many hours, if neglect be more ent than attention. In fact, the process is thoroughly barbarous, ed without industry or reflection; it is mostly carried on by ls and Hottentots, but not by Kaffirs. "The only aloë I have ed," says Mr. MacOwan, "is the very large one with di- or omous inflorescence,—*A. ferox*, I believe." Backhouse[1] also *Aloë ferox?*" as the species he saw used near Port Elizabeth

n another correspondent, we learn that the making of aloes in the olony is not carried on by preference, but is resorted to when ofitable work is scarce. The drug is sold by the farmers to the its of the towns on the coast, some of whom have exerted them- obtain a better commodity, and have even imported living aloe- om Barbados.

ing is known of the manufacture of the so-called *Socotrine* r even with certainty in what precise localities it is carried on.

eral Description—The differences in the several kinds of cial aloes are due to various causes, such as the species of *Aloë* d and the method of extracting the juice. The drug varies ex- y: some is perfectly transparent and amorphous, with a glassy lal fracture; some is opaque and dark with a dull waxy fracture, ie and pallid; or it may be of a light orange-brown and highly ne. It varies in consistence in every degree, from dry and o pasty, and even entirely fluid and syrup-like.

e diverse conditions are partially explained by an examination ery fluid aloes that has been imported of recent years from . If some of this aloes is allowed to repose, it gradually sepa- to two portions,—the upper a transparent, black liquid,—the n orange-brown crystalline sediment. If the whole be allowed rate spontaneously, we get aloes of two sorts in the same mass; from the upper portion being dark, transparent and amorphous, r rather opaque and highly crystalline. Should the two layers mixed, an intermediate form of the drug results.

Hepatic Aloes of the old writers[2] was doubtless this rather form of Socotrine Aloes; but the term has come to be used some- guely for any sort of liver-coloured aloes, and appears to us y to be retained. Much of the opaque, so-called *Hepatic Aloes*, however owe its opacity to crystals, but to a feculent matter re of which is doubtful.

odour of aloes is a character which is much depended on by for distinguishing the different varieties, but it can only be ted by experience, and certainly cannot be described.[3]

to Mauritius and South Africa, , also 121.

cer Floridus in the 10th century, s:—

s species geminæ, quæ subrubet estque t hepar cum frangitur, hæc *epatite* magnas habet in medicamine vires, eo quæ fracta colore videtur."

[3] Thus the pale, liver-coloured aloes of Natal is invariably associated with the transparent Cape Aloes, simply from the fact that the two drugs have a similar smell. Again, the aloes of Curaçao is at once recognized by its odour, which an experienced druggist pronounces to be quite different from that of the aloes produced in Barbados.

Varieties—The principal varieties of aloes found in Engli merce are the following:—

1. *Socotrine Aloes*—also called *Bombay, East Indian,* or . *Aloes,* and when opaque and liver-coloured, *Hepatic Aloes.* I ported in kegs and tin-lined boxes from Bombay, whither it l carried by the Arab traders from the African coast, the Red S or by way of Zanzibar, from Socotra. When of fine quality, it dark reddish-brown, of a peculiar, rather agreeable odour, comp myrrh or saffron. In thin fragments, it is seen to be of an orange its powder is of a tawny reddish-brown. When moistened wit of wine, and examined in a thin stratum under the microsco Socotrine Aloes is seen to contain an abundance of crystals. ported, it is usually soft, at least in the interior of the mass, speedily dries and hardens by keeping.[1] It is occasionally imp a completely fluid state (*Liquid Socotrine Aloes, Aloë Juice*), an unfrequently somewhat sour and deteriorated.

Some fine aloes from Zanzibar, of which a very small quant offered for sale in 1867, was contained in a skin, and composed layers, the one amorphous, the other a granular translucent subst light colour, which when softened and examined with a lens, w to be a mass of crystals. A very bad, dark, fœtid sort of a brought to Aden from the interior. It seems to be the *Moka* some writers.

The quantity of aloes imported into Bombay in the year 18 was 892 cwt., of which 736 cwt. are reported as shipped from th Sea ports and Aden.[2]

2. *Barbados Aloes*—Characteristic samples show it as a h substance of a deep chocolate-brown, with a clean, dull, waxy f In small fragments it is seen to be translucent and of an orange-hue. When breathed upon, it exhales an odour analogous to b distinguishable from that of Socotrine aloes. It is imported i and gourds. The gourds, into which the aloes has been pou melted state through a square hole, over which a bit of calic wards nailed, contain from 10 to 40 ℔. or more. Of late years, B aloes having a smooth and glassy fracture has been importe known to the London drug-brokers as "*Capey Barbados.*" By k it passes into the usual variety having a dull fracture.

The export of aloes from Barbados in 1871, as shown by th *Book* for that colony, was 1046 cwt., of which 954 cwt. were shi the United Kingdom.

3. *Curaçao Aloes*—manufactured in the Dutch West Indian of Curaçao, is imported into this country by way of Holland, p boxes of 15 to 28 ℔. each. In appearance, it resembles Barba but has a distinctive odour.

4. *Cape Aloes*—The special features of this sort of alo brilliant conchoidal fracture and peculiar odour. Small splint

[1] The average loss as estimated in the drying of 560 ℔., upon several occasions, was about 14 per cent.—Laboratory statistics, communicated by Messrs. Allen and Hanburys, London.

[2] *Statement of the Trade and N of the Presidency of Bombay* pt. ii. 19.

ransmitted light, are highly transparent and of an amber colour; the 'der is of a pale tawny yellow. When the drug is moistened and mined under the microscope, no crystals can be detected, even after lapse of some days. Cape aloes has the odour of other kinds of s, with a certain sourish smell which easily distinguishes it. Several lities are recognized, chiefly by the greater or lesser brilliancy of ture, and by the tint of the powder.

From the *Blue Book* for the Colony of the Cape of Good Hope, lished at Cape Town in 1873, it appears that the export of aloes in 2, was 484,532 lb. (4326 cwt.); and that the average market value ing the year was 3¾*d.*, the lowest price, 1½*d.* being at Riversdale and ssel Bay, and the highest, 11*d.* at Swellendam. The drug is shipped n Cape Town, Mossel Bay and Algoa Bay.

5. *Natal Aloes*—Aloes is also imported from Natal, and since 1870 considerable quantity. Most of it is of an hepatic kind and com- ely unlike the ordinary Cape aloes, inasmuch as it is of a greyish- wn and very opaque. Moreover it contains a crystalline principle ch has been found in no other sort of aloes.

The drug is manufactured in the upper districts of Natal, between ternaritzburg and the Quathlamba mountains, especially in the voti and Mooi River Counties, at an elevation of 2000 to 4000 feet ve the sea. The plant used is a large aloë which has not yet been nically identified.[1] The people who make the drug are British and ch settlers, employing Kaffir labourers. The process is not very erent from that followed in making Cape aloes, but is conducted with e intelligence. The leaves are cut obliquely into slices, and allowed xude their juice in the hot sunshine. The juice is then boiled down ron pots, some care being taken to prevent burning, by stirring the id as it becomes thick. The drug while still hot, is poured into den cases, in which it is shipped to Europe.[2] The exports from the ny have been as follows :—[3]

1868	1869	1870	1871	1872
none	38 cwt.	646 cwt.	372 cwt.	501 cwt.

Chemical Composition—All kinds of aloes have an odour of the character and a bitter disagreeable taste. The odour which is often unpleasant, especially in Socotrine aloes, is due to a *volatile oil*, h the drug contains only in minute proportion. T. and H. Smith of burgh, who contributed a specimen of it to the Vienna Exhibition 73, inform us that they obtained it by subjecting to distillation with , 400 lb. of aloes, which quantity they estimate to have yielded an ounce. The oil is stated in a letter we have received from to be a mobile pale yellow liquid, of sp. gr. 0·863, with a boiling of 266–271° C.

are aloes dissolves easily in spirit of wine with the exception of a occuli; it is insoluble in chloroform and bisulphide of carbon, as s in the so-called petroleum ether, the most volatile portion of

ave small specimens of it raised from mmunicated by a maker of the drug the good offices of a Natal merchant on.—D. H.

[2] We have to thank J. W. Akerman, Esq., of Pietermaritzburg, for the foregoing information as to the manufacture of this drug.

[3] *Blue Books for the Colony of Natal for* 1868, 1869, 1870, 1871, 1872.

American petroleum. The sp. gr. of fine transparent fragments dried at 100° C., and weighed in the last-named fluid at 16 found by one of us (F.) to be 1·364; showing that aloes is m ponderous than most of the resins, which seldom have a high than 1·00 to 1·10. In water, aloes dissolves completely on heated. On cooling, the aqueous solution, whether concent dilute, becomes turbid by the separation of resinous drops, whi into a brown mass,—the so-called *Resin of Aloes.*[1] The clear after separation of this substance, has a slightly acid reactio coloured dark brown by alkalis, black by ferric chloride, and is tated yellowish-grey by neutral lead acetate. Cold water dissol half its weight of aloes, forming an acid liquid which exhibit reactions. The solution of aloes in potash or ammonia is pre by acids, but not by water.

The most interesting constituents of aloes, are the substance as *Aloïn.* This name was originally applied to an aloïn whi appears to be found exclusively in Barbados aloes, is now term *baloïn,* in order to distinguish it from allied substances occu Natal and Socotrine aloes.

Barbaloïn was discovered by T. and H. Smith of Edinburgh i and was shortly afterwards described by Stenhouse.[3] From good of the drug, it can be obtained according to Tilden[4] as a cry mass, to the extent of 20 to 25 per cent., but in others it appears partly amorphous or in a chemically altered state. Barbaloïn is a substance, crystallizing in tufts of small yellow prisms, which doubly refractive by polarized light. These crystals represent A aloïn, and part with one equivalent of water (= 2·69 per cent.) by cation *in vacuo,* or by the prolonged heat of a water-bath. Ba $C^{34}H^{36}O^{14} + H^2O$, dissolves sparingly in water or spirit of wi very freely if either liquid be even slightly warmed; it is in in ether.

The solutions alter quickly if made a little alkaline, but if or slightly acid, are by no means very prone to decomposition oxidation with nitric acid, barbaloïn yields, as Tilden has shown a third of its weight of chrysammic acid, besides aloëtic, oxalic and acids. It easily combines with bromine to form a neutral sub crystallizing in yellow needles, named *Bromaloïn,* $C^{34}H^{30}Br^6O$ chloro-derivative, *Chloraloïn,* crystallizing in prisms, and havi formula, $C^{34}H^{30}Cl^6O^{14} + 6H^2O$, has likewise been obtained.[5]

In examining Natal aloes in 1871, we observed it to con crystalline body, much less soluble than the ordinary aloïn of Ba aloes. Further examination proved its distinctness from this latte we have accordingly named it *Nataloïn.*

Nataloïn exists naturally in Natal aloes, from which it can be prepared in the crude state, if the drug is triturated with an

[1] The average yield of aqueous extract made by the pharmacopœia process from commercial Socotrine aloes containing about 14 per cent. of water, was found from the record of five experiments, in which 179 lb. were used, to be 62·7 per cent. Barbados aloes, which is always much drier, afforded on an average 80 per cent.

[2] Most beautiful specimens have b sented to each of us by these gentle

[3] *Phil. Mag.* xxxvii. (1851) 481.

[4] *Pharm. Journ.* April 20, 1872 See also Nov. 5, 1870. 375.

[5] Tilden in *Journ. of Chem. Soc.* 204.

ht of spirit of wine at a temperature not exceeding 48° C. This dissolve the amorphous portion, from which the crystals should be rated by a filter, and washed with a small quantity of cold spirit. ı 16 to 25 per cent. of crude nataloïn in pale yellow crystals may be extracted. When purified by crystallization from methylic alcohol ›irit of wine, it forms thin, brittle, rectangular scales, often with one ore of their angles truncated. The formula assigned to nataloïn by ›n,[1] which is supported by the composition of the acetyl derivative ıs succeeded in obtaining is, $C^{25}H^{28}O^{11}$.

ıt 15·5° C., 60 parts of spirit of wine, 35 of methylic alcohol,[2] 50 cetic ether, 1236 of ether, and 230 of absolute alcohol, dissolve ›ctively one part of nataloïn. It is scarcely more soluble in warm in cold spirit of wine, so that to obtain crystals it is best to allow olution to evaporate spontaneously. Water, hot or cold, dissolves ›ry sparingly. Nataloïn gives off no water when exposed over oil triol, or to a temperature of 100° C. By the action of nitric acid, fords both oxalic and picric acids, but no chrysammic acid. It ars not to combine with chlorine or bromine, and we have failed in ning from it any such body as bromaloïn.

.iquid Socotrine aloes imported into London about 1852, was noticed ereira to abound in minute crystals, which he termed the *Aloïn of rine Aloes*, and regarded as probably identical with that of Barbados . Groves (1856) obtained it from commercial Socotrine aloes, h when of a light brownish orange, opaque and soft, as it often is ı freshly imported, is easily seen to be extremely crystalline. Some lry aloes from Zanzibar of very pale hue, in our possession, is in ›y a perfectly crystalline mass.

listed, who at the request of one of us had undertaken the examina- of some samples of aloes, was the first to assert that the crystalline ›r of Socotrine or Zanzibar aloes is a peculiar substance, according er with barbaloïn nor with nataloïn. This observation was fully borated by our own experiments,[3] made chiefly on the Zanzibar just described, and we shall call the substance thus discovered *›ïn*.[4] In this drug, the crystals are prisms of comparatively large such as we have never observed in Natal aloes. They cannot be so ; isolated as nataloïn, since they are nearly as soluble as the phous matter surrounding them. Histed, who has supplied us with ›iful specimens, recommends treating the powdered crude drug with ›le alcohol, sp. gr. 0·960, and strongly pressing the pasty mass ›en several thicknesses of calico; then dissolving the yellow crystal- cake in warm weak alcohol, and collecting the crystals which are ›d by cooling and repose.

›ocaloïn forms tufted acicular prisms, which by solution in methylic ol, may be got 2 to 3 millimetres long. It is much more soluble nataloïn. At ordinary temperatures, 30 parts of spirit of wine, 9 etic ether, 380 of ether, 90 of water, are capable of dissolving ›tively one part of socaloïn; while in methylic alcohol, it is most lantly soluble. Socaloïn is a hydrate, losing when dried over oil of

›mical News, May 17, 1872. 229; . *Journ.* May 25, 1872. 951.

›e best crystals can be got by this ›.

[3] Flückiger, *Crystalline Principles in Aloes*,—*Pharm. Journ.* Sept. 2, 1871. 195.

[4] The term *Zanzibar Aloïn* first employed, being a somewhat clumsy phrase and not particularly correct.

vitriol 11 to 12 per cent. of water, but slowly regaining it if after exposed to the air. Its elementary composition according to the an made by one of us (F.) is $C^{34}H^{38}O^{15} + 5H^2O$. We have not succ in obtaining any well-defined bromine compound of socaloïn.

The three aloïns, *Barbaloïn*, *Nataloïn*, and *Socaloïn*, are distinguished by the following beautiful reaction first noticed by Hi —a drop of nitric acid on a porcelain slab gives with a few partic barbaloïn or nataloïn, a vivid crimson,[1] but produces little effect socaloïn. To distinguish barbaloïn from nataloïn, test each by add minute quantity to a drop or two of oil of vitriol, then allowing *vapour* from a rod touched with nitric acid to pass over the su Barbaloïn (and socaloïn) will undergo no change, but nataloïn assume a fine blue.[2]

The latest researches on aloïn are those of E. von Sommaruga Egger in Prof. Rochleder's laboratory in Vienna (1874), and have l directed in particular to the aloïn of Socotrine aloes. The melt point of this aloïn was found to be between 118° and 120° C., tha barbaloïn being much higher. Comparing the published analyses of two other kinds of aloïn with those obtained by themselves for socal the authors conclude that the three form an homologous series, and t their composition may probably be represented thus:—

Barbaloïn	$C^{17}H^{20}O^7$
Nataloïn	$C^{16}H^{18}O^7$
Socaloïn	$C^{15}H^{16}O^7$

The portion of aloes insoluble in cold water, was formerly di tinguished as *Resin of Aloes*, from the soluble portion which was *Bitter of aloes* or *Aloëtin*. From the labours of Kosmann (1862) portions appear to have nearly the same composition. The portion treated with dilute sulphuric acid, is said to yield *Al Aloëretic Acids*, both crystallizable, besides the indifferent *Aloëretin*. These observations have not to our knowledge been

It has been shown by Tilden and Rammell[3] that the *Re* (p. 624) may by prolonged treatment with boiling water be into two bodies, which they distinguish as *Soluble Resin A.* and *soluble Resin B.* With the first, it is possible to form a brominated pound, which though non-crystalline is apparently of definite sition. In the view of these chemists the *Resin A.* is a kind of dride of barbaloïn, standing in the same relation to barbal ether does to alcohol, or tannic acid to gallic acid, thus:—Bi $2(C^{34}H^{36}O^{14})$ less H^2O = Aloe Resin A., $C^{68}H^{70}O^{27}$. The resin with nitric acid, yields a large amount of chrysammic acid, together picric and oxalic acids, and carbonic anhydride. *Insoluble Re* found to have nearly the same composition as *Resin A.*

Aloes treated with various reagents, affords a number of remark products. Thus, according to Rochleder and Czumpelick (1861) when boiled with soda-lye, colourless crystals an inch long, which to consist of a salt of *Paracumaric Acid*, together with small quan of fragrant essential oils, volatile fatty acids, and a volatile base.

[1] Rapidly fading in the case of barbaloïn, but permanent with nataloïn unless heat be applied.

[2] These reactions may be so even with the crude drugs.

[3] *Pharm. Journ.* Sept. 21, 1872.

When boiled with dilute sulphuric acid, it yields paracumaric acid, om which by fusion with caustic potash, as also directly from aloes, Hlasiwetz (1865) obtained *Para-oxybenzoic Acid* (p. 365). Weselsky 1872–73) has shown that accompanying the last two products, there is peculiar acid, $C^9H^{10}O^3$, which he has named *Aloresinic Acid.*

By distillation with quick-lime, E. Robiquet (1846) obtained *Aloïsol*, yellowish oil, liquid at − 20° C., which Rembold (1866) proved to be a ixture of *Xylenol*, $C^8H^{10}O$, with acetone and hydrocarbons.

Nitric acid forms with Barbados aloes, but still better as Tilden has own,[1] with barbaloïn, *Aloëtic Acid*, $C^{14}H^4(NO^2)^4O^2$, *Chrysammic Acid*, $^{14}H^4(NO^2)^4O^4$, and finally *Picric Acid*, together with *Oxalic Acid.* The rst two of these acids are distinguished by the splendid tints of their alts, which might be utilised in dyeing.

Chlorine passed into an aqueous solution of aloes, forms a variety of ubstitution-products, and finally *Chloranil*, $C^6Cl^4O^2$.

When somewhat strongly heated, aloes swells up considerably, and fter ignition, leaves a light, slow-burning charcoal, almost free from norganic constituents. Ordinary Cape aloes, for example, dried at 00 C., leaves only 1 per cent. of ash.

Commerce—There were imported into the United Kingdom in the ear 1870, 6264 cwt. of aloes. Of this quantity, South Africa shipped 811 cwt.; and Barbados 970 cwt. The remainder was probably rnished by Eastern Africa.

The commercial value of the varieties of aloes is very different. At esent (June 1874) *Barbados Aloes* is quoted in price-currents at £3 5*s.* £9 10*s.* per cwt.; *Socotrine* at £5 to £13; while *Cape Aloes* is offered £1 10*s.* to £2. In England, the first two alone are allowed for armaceutical preparations. Even the *Veterinary Pharmacopœia*[2] mes only *Aloë Barbadensis.* Cape Aloes is esteemed on the Continent, d chiefly consumed there.

Use—Aloes is a valuable purgative in very common use; it is nerally given combined with other drugs.

Adulteration—The physical characters of aloes, such as colour of powder, odour, consistence and freedom from obvious impurity, upled with its solubility in weak alcohol, usually suffice for determining goodness.

BULBUS SCILLÆ.

adix Scillæ; Squill; F. *Bulbe ou squames de Scille, Ognon marin;* G. *Meerzwiebel.*

Botanical Origin—*Urginea maritima* Baker[3] (*Scilla maritima* L., *inea Scilla* Steinheil). It is found generally in the regions bordering Mediterranean, as in Southern France, Italy, Dalmatia, Greece, Asia or, Syria, North Africa and the Mediterranean islands. It is very mon throughout the South of Spain, where it is by no means confined e coast; it occurs also in Portugal.

Pharm. Journ. April 20, 1872, 845.
By R. V. Tuson, London, 1869.
Journ. of Linn. Soc., Bot., xiii. (1872)
The genus *Urginea* has flat, discoid while in *Scilla* proper they are triquetrous. The name *Urginea* was given in allusion to the Algerian tribe Ben *Urgin*, near Bona, where Steinheil (1834) examined this plant.

Two varieties of squill, termed respectively *white* and *red*, are disti guished by druggists. In the first, the bulb-scales are colourless; in t second they are of a roseate hue. No other difference in the plants c be pointed out, nor have the two varieties distinct areas of growth.

History—Squill is one of the most ancient of medicines. Epimenid a Greek who lived in the 30th Olympiad, is said to have made mu use of it, from which circumstance it came to be called *Epimenidea*.[1] is also mentioned by Theophrastus, and was probably well known to a the ancient Greek physicians. Pliny was not only acquainted with i but had noticed its two varieties. Dioscorides describes the method c making vinegar of squills; and a similar preparation, as well as com pounds of squill with honey, were administered by the Arabian physician and still remain in use.

Description—The bulb of squill is pear-shaped, and of the size of a man's fist or larger, often weighing more than four pounds. It has the usual structure of a tunicated bulb; its outer scales are reddish-brown, dry, scarious, and marked with parallel veins. The inner are fleshy and juicy, colourless or of a pale rose tint, thick towards the middle, very thin and delicate at the edges, smooth and shining on the surface. The fresh bulb has a mucilaginous, bitter, acrid taste, but not much odour.

For medicinal use, squill is mostly imported ready dried. The bulbs are collected in the month of August, at which period they are leafless, freed from their dry outer scales, cut transversely into thin slices, and dried in the sun. Thus prepared, the drug appears in the form of narrow, flattish or four-sided curved strips, 1 to 2 inches long, and $\frac{3}{8}$ to $\frac{1}{2}$ of an inch wide, flexible, translucent, of a pale dull yellowish colour, or when derived from the red variety, of a decided roseate hue. When thoroughly dried, they become brittle and pulverizable, but readily absorb water to the extent of about 11 per cent. Powdered squill by the absorption of water from the air, readily cakes together into a hard mass.

Microscopic Structure—The officinal portion of the plant being simply modified leaves, has the histological characters proper to many of those organs. The tissue is made up of polyhedral cells, covered on both sides of the scales by an epidermis provided with stomata. It is traversed by numerous vascular bundles, and also exhibits smaller bundles of laticiferous vessels. If thin slices of squill be moistened with dilute alcohol, most of the parenchymatous cells are seen to be loaded with *mucilage*, which contracts into a jelly on the addition of alcohol. In the interior of this jelly, crystalline particles are met with consisting of oxalate of calcium. This salt is largely deposited in cells, forming either bundles of needle-shaped crystals, or large solitary square prisms frequently a millimetre long. In either case, they are enveloped by the mucilaginous matter already mentioned. Oxalate of calcium as occurring in other plants has been shown in many instances to originate in the midst of mucilaginous matter. The fact is remarkably evident in Squill, especially when examined in polarized light.

On shaking thin slices of the bulb with water, the crystals are deposited in sufficient quantity to become visible to the naked eye, though their weight is actually very small. Direct estimation of the oxalic acid (by titration with chamæleon solution) gave us only 3·07 per cent of

[1] Haller, *Bibliotheca Botanica*, i. 12.

$_1O^4$, $3H^2O$ from white squill dried at 100° C., which moreover yielded ·2 to 5 per cent. of ash. It is these extremely sharp brittle crystals :h occasion the itching and redness, and sometimes even vesication, :h result from rubbing a slice of fresh squill on the skin. These :ts which have long been known, were attributed to a volatile acrid ciple, until their true cause was recognized by Schroff.[1]

The mucilage also contains albuminous matters, hence the orange ur it assumes on addition of iodine. The vascular bundles are mpanied by some rows of longitudinally extended cells, containing a ll number of starch granules. In the red squill, the colouring matter ntained in many of the parenchymatous cells, others being entirely id of it. It turns blackish-green, if a persalt of iron be added.

Chemical Composition—The most abundant among the consti- ts of squill is *Mucilage*, which may be precipitated by neutral acetate ead. Alcohol added to an aqueous infusion of squill, causes the ration of the mucilage together with albuminoid matter. If the ıol is evaporated and a solution of tannic acid is added, the latter combine with the *bitter principle* of squill, which has not yet been ted, although several chemists have devoted to it their investigations applied to it the names of *Scillitin* or *Skuleïn*. We have obtained ısiderable amount of an uncrystallizable levogyre sugar, by exhausting ll with dilute alcohol.[2] Schroff, to whom we are indebted for a able monograph on Squill,[3] infers from his physiological experi- ts, the presence of a non-volatile acrid principle (*Skulein* ?), together scillitin, which latter he supposes to be a glucoside.

Commerce—Dried squill, usually packed in casks, is imported into and from Malta.

Use—Commonly employed as a diuretic and expectorant.

Substitutes—There are several plants of which the bulbs are used ıe place of the officinal squill, but which, owing to the abundance low price of the latter, never appear in the European market.

1. *Urginea altissima* Baker (*Ornithogalum altissimum* L.), a South can species, very closely related to the common squill and having, as ould appear, exactly the same properties.[4]

2. *U. indica* Kth. (*Scilla indica* Roxb.), a widely diffused plant, rring in Northern India, the Coromandel Coast, Abyssinia, Nubia, Senegambia. It is known by the same Arabic and Persian names *U. maritima*, and its bulb is used for similar purposes. But according Moodeen Sheriff[5] it is a poor substitute for the latter, having little or ction when it is old and large.

3. *Scilla indica* Baker[6] (non Roxb.), (*Ledebouria hyacinthina* Roth), ve of India and Abyssinia, has a bulb which is often confused in the

We have found that the slimy juice of aves of *Agapanthus umbellatus* Hérit., is very rich in spicular crystals, also ons when rubbed on the skin both g and redness lasting for several hours. n Greece, they have even attempted to facture alcohol by fermenting and dis- squill bulbs.—Heldreich, *Nutzpflan- riechenlands*, 1862. 7.

[3] Reprinted from the *Zeitschrift der Gesellschaft der Aerzte zu Wien*, No. 42 (1864). Abstracted also in Canstatt's *Jahresbericht* 1864. 19, and 1865. 238.

[4] Pappe, *Floræ Medicæ Capensis Prodromus*, ed. 2, 1857. 41.

[5] *Supplement to the Pharmacopœia of India*, Madras, 1869. 250.

[6] Saunders, *Refugium Botanicum*, iii. (1870) appendix, p. 12.

The bulb has been admitted to the *Pharmacopœia of India* (18
on the recommendation of O'Shaughnessy, who considers it
emetic. We have not been able to examine a specimen, a
learn that the drug has been the subject of any chemical inves

MELANTHACEÆ.

RHIZOMA VERATRI ALBI.

Radix Veratri, Radix Hellebori albi; White Hellebore; F. *d'Ellébore blanc;* G. *Weisse Nieswurzel, Germer.*

Botanical Origin—*Veratrum album* L.—This plant occu
grassy places in the mountain regions of Middle and Southe
as Auvergne, the Pyrenees, Spain, Switzerland and Austria
grows throughout European and Asiatic Russia, as far as 61°
Amurland, the island of Saghalin, Northern China and Japan.

History—The confusion that existed among the ancien
Melampodium, *Helleborus* and *Veratrum*, makes the identificat
plant under notice extremely unsatisfactory.[3]

It was perfectly known to Gerarde (*circa* A.D. 1600); and
names of *Elleborus* (or *Helleborus*) *albus* and *Veratrum*, it has l
in all the London Pharmacopœias. In the British Pharmacop
it has been replaced by the nearly allied American species,
viride Ait.

Description—White Hellebore has a cylindrical, fleshy,
rootstock, 2 to 3 inches in length, and ¾ to 1 inch in diameter,
long stout roots. When fresh it has an alliaceous smell. In
state as it occurs in commerce it is cylindrical or subconical

The drug has a sweetish, bitterish acrid taste, leaving on the tongue ensation of numbness and tingling. In the state of powder, it occa- ns violent sneezing.

Microscopic Structure—When cut transversely, the rhizome shows a distance of 2—4 mm. from the thin dark outer bark, a fine brown zigzag e (medullary sheath) surrounding the central part, which exhibits a h, not well defined. The zone between the outer bark and the me- llary sheath is pure white, with the exception of some isolated cells ntaining resin or colouring matter, and those places where the rootlets ss from the interior. The latter is sprinkled as it were, with short n somewhat lighter bundles of vessels which run out irregularly in all ections. The parenchyme of the entire rhizome is filled with starch, l contains numerous needles of calcium oxalate. The rootlets, which collectors usually remove, are living and juicy only in the upper lf of the rhizome, the lower half of which is rather woody and porous.

Chemical Composition—In 1819, Pelletier and Caventou detected the rhizome of *Veratrum*, a substance which they regarded as identical h veratrine, the existence of which had just been discovered by W. issner in cebadilla seeds. But according to the recent observations of agendorff,[1] the veratrine of cebadilla cannot be found either in *Vera- m album* or *V. viride*.

Simon (1837) found in the root a second alkaloid, *Jervine*, $C^{30}H^{46}N^2O^3$, l to be distinguished from veratrine by the sparing solubility of its s, especially its sulphate, in water. C. L. Mitchell (1874) has ex- ted jervine from both *Veratrum album* and *V. viride*. He obtained he first instance the sulphate in the form of a granular powder: from he separated the alkaloid as a light white substance, tasteless and lorous, of feebly alkaline reaction, capable of crystallizing from alcohol. most characteristic reaction is said to be with strong sulphuric acid, ch colours it first yellow, then green.

Weppen (1872) has isolated from this drug *Veratramarin*, an amor- is, deliquescent, bitter principle. It occurs in minute quantity only, is resolvable into sugar and other products. Veratramarin dissolves ater or spirit of wine, not in ether or in chloroform. The same ver has also isolated to the extent of ½ per mille, *Jervic Acid* in crystals of considerable size, of the composition, $C^{14}H^{10}O^{12} + 2\,H^2O$. acid requires 100 parts of water for solution at the ordinary tem- ure, and a little less of boiling alcohol. It is decidedly acid, and well-defined crystallizable salts, containing 4 equivalents of metal. y exhausting the entire rhizome (roots included) with ether and lrous alcohol, we obtained 25·8 per cent. of soft resin, which deserves r examination. Pectic matter to the amount of 10 per cent. was d out by Wiegand in 1841.

ccording to Schroff (1860) the active principle of white hellebore s in the cortical part of the rootlets, the woody central portion inert. He also asserts that the rhizome acts less strongly than otlets, and in a somewhat different manner.

ommerce—The drug is imported from Germany in bales. The currents distinguish *Swiss* and *Austrian*, and generally name the s "*without fibre*."

[1] *Beitr. zur gerichtl. Chemie*, St. Petersb., 1872. 95.

Uses—Veratrum is an emetic and drastic purgative, rarely used internally. It is occasionally employed in the form of ointment in scabies. Its principal consumption is in veterinary medicine.

Substitutes—The rhizome of the Austrian *Veratrum nigrum* L. is said to be sometimes collected instead of White Hellebore; it is of much smaller size, and according to Schroff, less potent. That of the Mexican *Helonias frigida* Lindl. (*Veratrum frigidum* Schl.) appears to exactly resemble that of *Veratrum album.*

RHIZOMA VERATRI VIRIDIS.

American White Hellebore,[1] *Indian Poke.*

Botanical Origin—*Veratrum viride* Aiton, a plant in every respect closely resembling *V. album*, of which it is one of the numerous forms. In fact, the green-flowered variety of the latter (*V. Lobelianum* Bernh.), a plant not uncommon in the mountain meadows of the Alps, comes so near to the American *V. viride* that we are unable to point out any important character by which the two can be separated.[2] The American *Veratrum* is common in swamps and low grounds from Canada to Georgia.

History—The aborigines of North America were acquainted with the active properties of this plant before their intercourse with Europeans, using it according to Josselyn,[3] who visited the country in 1638–1671, as a vomit in a sort of ordeal. He calls it *White Hellebore*, and states that it is employed by the colonists as a purgative, antiscorbutic and insecticide.

Kalm (1749) states[4] that the early settlers used a decoction of the roots to render their seed-maize poisonous to birds, which were made "delirious" by eating the grain, but not killed; and this custom was still practised in New England in 1835 (Osgood).

The effects of the drug have been repeatedly tried in the United States during the present century; and about 1862, in consequence of the strong recommendations of Drs. Osgood, Norwood, Cutter, and others, it began to be prescribed in this country.

Description—In form, internal structure, odour and taste, the rhizome and roots accord with those of *Veratrum album*; yet owing to the method of drying and preparing for the market, the American veratrum is immediately distinguishable from the White Hellebore of European commerce. We have met with it in three forms:—

1. The rhizome with roots attached, usually cut lengthwise into quarters, sometimes transversely also, densely beset with the pale brown

[1] The name *Green Hellebore* is sometimes applied to this drug, but it properly belongs to *Helleborus viridis* L., which is medicinal in some parts of Europe.

[2] Sims in contrasting *Veratrum viride* with *V. album* observes that the flowers of the former are "more inclined to a yellow green," the petals broader and more erect, with the margins, especially about the claw, thickened and covered with a white mealiness. *Bot. Mag.* xxvii. (1808) tab. 1096.—Regel has described four varieties of *Veratrum album* L., as occurring in the region of the Lower Ussuri and Amurland, one of which, var. γ., he has identified with the American *V. viride.*—*Tentamen Floræ Ussuriensis*. Petersb. 1861. 153.

[3] *New England's Rarities discovered*, Lond. 1672. 43; also *Account of two Voyages to New England*, Lond., 1674, 60. 76.

[4] *Travels in North America*, vol. ii. 91.

:h towards their extremities are clothed with slender fibrous

ɔme and roots compressed into solid rectangular cakes, an
.ckness.

hizome *per se*, sliced transversely and dried. It forms whitish,
ɔwnish discs, ½ to 1 inch or more in diameter, much shrunken
by drying. This is the form in which the drug is required
ited States Pharmacopœia.

ical Composition—No chemical difference between *Veratrum*
V. album has yet been ascertained. The presence of veratrine,
by previous chemists, was asserted by Worthington [1] in 1839,
ıardson of Philadelphia in 1857, and S. R. Percy in 1864.
d[2] obtained from the American drug, 0·4 per cent. of this
vhich however, in consequence of some observations of Dra-
p. 631), we must hold to be doubtfully identical with that of
As stated in a previous page, jervine is present as in the
llebore of Europe. The resin may be prepared by exhausting
ıg alcohol and precipitating with boiling acidulated water,
the process in order to entirely eliminate the alkaloids. It is
rown mass, yielding about a fourth of its weight to ether.
ıd obtained it to the extent of 4½ per cent. By exhausting
ıccessively with ether, absolute alcohol and spirit of wine, we
from it not less than 31 per cent. of a soft resinoid mass.
:on pointed out the presence of gallic acid and of sugar.

—*Veratrum viride* has of late been much recommended as a
'terial and nervous sedative. It is stated to lower the pulse,
ıtion and heat of the body, not to be narcotic, and rarely to
ɔurging;[3] but to what principle these effects are due, has not
.scertained. By some observers, as Bigelow,[4] Fée,[5] Schroff,[6] and
it is alleged to have the same medicinal powers as the Euro-
:trum album.

SEMEN SABADILLÆ.

ıbadilla; Cebadilla, Cevadilla; F. *Cévadille;* G. *Sabadillsamen, Läusesamen.*

ıical Origin—*Asagræa officinalis* Lindley (*Veratrum officinale*
Sabadilla officinarum Brandt, *Schœnocaulon officinale* A. Gray).
ous plant, growing in Mexico, in grassy places on the eastern
ɔ of the volcanic range of the Cofre de Perote, and Orizaba, near
Iuatusco and Zacuapan, down to the sea-shore, also in Guate-
ebadilla is (or was) cultivated near Vera Cruz, Alvarado and
ıan in the Gulf of Mexico.

ıer form of *Asagræa*, first noticed by Berg,[8] but of late more
'ly by Ernst of Caracas, who thinks it may constitute a distinct

ıra. of Pharm. iv. (1839) 89.
Am. Pharm. Assoc. 1862. 226.
Lancet, Jan. 4, Aug. 16, 1862;
ıra. iv. (1863) 134.
ıa Medical Botany, ii. (1819)
Hist. Nat. Pharm. i. (1828) 319.
[6] *Medizinische Jahrbücher*, xix. (Vienna, 1863) 129-148.
[7] Buchner's *Repertorium für Pharmacie*, xviii. (1868) 50; also Wiggers and Husemann's *Jahresbericht*, 1868. 505.
[8] Berg u. Schmidt, *Offiz. Gewächse*, i. (1858) tab. ix. e.

species, is found in plenty on grassy slopes, 3500 to 4000 feet the sea-level, in the neighbourhood of Caracas, and southward hilly regions bordering the valley of the Tuy.[1] It differs chi having broader and more carinate leaves. Of late years it has fur large quantities of seed, which, freed from their capsules, have shipped from La Guaira to Hamburg.[2]

History—Cebadilla was first described in 1571 by Monarde states that it is used by the Indians of New Spain as a caust corrosive application to wounds; but it does not seem to have been b into European commerce, for neither Parkinson who described it ir as the *Indian Causticke Barley*, nor Ray (1693) did more than cop Monardes.

In the latter half of the last century, it began to be recommen France and Germany for the destruction of pediculi. A famous position for this purpose was the *Poudre des Capucins*, consistin mixture of stavesacre, tobacco, and cebadilla, which was applied dry or made into an ointment with lard.[3] Cebadilla was also admini combined into a pill with gamboge and valerian,[4] for the destructi intestinal worms, but its virulent action made it hazardous.

Upon the introduction of veratrine into medicine about 1824, dilla attracted some notice, and was occasionally prescribed in the of tincture and extract; but it subsequently fell into disuse, and is only employed for the manufacture of veratrine.

Description—Each fruit consists of three oblong pointed foll about ½ an inch in length, surrounded below by the remains of 6-partite calyx, and attached to a short pedicel. The follicles are u at the base, spread somewhat towards the apex, and open by their v suture. They are of a light brown colour and papery substance usually contains two pointed narrow black seeds, $\frac{3}{10}$ of an inch in which are shining, rugose, and angular or concave by mutual pr The compact testa encloses an oily albumen, at the base of which site to the beaked apex, lies the small embryo. The seed is inod and has a bitter acrid taste; when powdered, it produces violent sne

Microscopic Structure—A transverse section shows the concentrically radiated albumen, closely attached to the testa. The consists of an outer layer of cuboid cells, and three rows of smaller walled, tangentially-extended cells, all of which have brown walls tissue of the albumen is made up of large porous cells, containing of oil, granules of albuminoid matter, and mucilage. Traces of t acid occur only in the outer layers of the seed.

Chemical Composition—W. Meissner in 1818, discovered in dilla the alkaloid *Veratrine*,[5] which in the following year was more

[1] Ernst, communication to the Linnean Society of London, 15 Dec. 1870.

[2] *Veratrum Sabadilla* Retzius is stated by Lindley (*Flora Medica*, p. 586) to be a native of Mexico and the West Indian Islands, and to furnish a portion of the cebadilla seeds of commerce. The plant is unknown to us: we have searched for it in vain in the herbaria of Kew and the British Museum. It is not mentioned as West Indian by Grisebach (*Flor. of Brit. W.I. Islands*, 1864; *Cat. Plant. Cubensium*, 1866). The figure by De[illegible] *méd. des Antilles*, iii. 1827, t. 19[illegible] the plant growing at St. Domi[illegible] to resemble *Veratrum album* [illegible] fore to be very different from *A*[illegible]

[3] Murray, *Apparatus Med*[illegible] (1790) 171; Mérat and De Lens, [illegible] *Méd.* vi. (1834) 862.

[4] Peyrilhe, *Cours d'Hist. Nat. M*[illegible] (1804) 490.

[5] So called from Schlechtendal's [illegible] the plant, *Veratrum officinale*.

tigated by Pelletier and Caventou. For many years this substance :nown only as an amorphous powder, in which state it frequently ined a considerable proportion of resin; but in 1855, it was obtained . Merck in large rhombic prisms. Cebadilla yields only about 3 per of veratrine. The alkaloid is easily soluble in spirit of wine, ether loroform; these solutions, as well as the watery solutions of its are devoid of rotatory power. Veratrine, like the drug from ı it is derived, occasions, if inhaled, prolonged sternutation. It ll doubtful whether the carpels contain the alkaloid, or whether it ıfined to the seed.

he alkaloids of cebadilla have been afresh investigated in Dragen- s laboratory by Weigelin,[1] who has found that veratrine exists under somerie modifications, the one *soluble* in water, the other *insoluble*, g the formula $C^{52}H^{86}N^{2}O^{15}$. Although he succeeded in crystallizing lkaloid, he could obtain the sulphate and hydrochlorate only in an phous state.

ouerbe (1834) discovered a second crystallizable alkaloid called *illine*, insoluble in ether, but according to Weigelin, soluble more or reely in water, benzol, petroleum ether, amylic alcohol, or chloro- From the benzol solution, it may be obtained in long colourless es. It saturates acids, and forms with sulphuric or hydrochloric amorphous gummy salts. The new analyses of Weigelin give to illine the formula, $C^{41}H^{66}N^{2}O^{13}$. Unlike veratrine, sabadilline does ccasion sneezing.

Veigelin in the course of his researches, detected in cebadilla a third id, which he has named *Sabatrine*, assigning, to it the formula $^{6}N^{2}O^{17}$. It is an uncrystallizable resin-like mass, soluble in ether, l, petroleum ether, amylic alcohol, or chloroform, and sparingly in . It neutralizes acids, forming amorphous salts. The veratrine ied in commerce, is stated by Weigelin always to contain more or f sabadilline and sabatrine.

ebadilla yielded to Pelletier and Caventou, a volatile fatty acid, *illic* or *Cevadic Acid*, the needle-shaped crystals of which fuse at . Lastly, E. Merck (1839) found a second peculiar acid termed *rie Acid*, $C^{18}H^{20}O^{8}$, affording quadrangular prisms, which can be ned without decomposition. It is yielded by cebadilla to the extent t ⅓ per mille.

ommerce—According to Ernst, the quantity of cebadilla (*seeds* shipped from La Guaira, the port of Caracas, is from 3000 to 3600 als annually. No other sort is now imported.

ses—Cebadilla is at present, we believe, only used as the source of ine. In Mexico, the bulb of the plant is employed as an anthel- c, under the name of *Cebolleja*, but it is said to be very dangerous action.

[1] *Untersuchungen über die Alkaloide des Samens*, Dorpat, 1871—an abstract of which may be found in Wiggers and Husemann's *Jahresbericht* for 1871. 24–30.

CORMUS COLCHICI.

Tuber vel Bulbus vel Radix Colchici; Meadow Saffron Root; F. *B Colchique;* G. *Zeitlosenknollen.*

Botanical Origin—*Colchicum autumnale* L.—This plant g meadows and pastures over the greater part of Middle and S Europe, and is plentiful in many localities in England and Irela the Swiss Alps, it ascends to an elevation of 5500 feet ab sea level.

History.—Dioscorides drew attention to the poisonous pr of Κολχικὸν, which he stated to be a plant growing in Messe Colchis.[1]

This character for deleterious qualities seems to have preven use of colchicum both in classical and mediæval times. Thus (1552) warns his readers against its use in gout, for which it is mended in the writings of the Arabians. Jacques Grévin, a ph of Paris, author of *Deux Livres des Venins*, dedicated to Queen El of England, and printed at Antwerp in 1568, observes—"ce poi ennemy de la nature de l'homme en tout et par tout."[2] Dodoe it *perniciosum Colchicum;* and Lyte in his translation of this (1578) says,—"Medow or Wilde Saffron is corrupt and venemous, fore not used in medicine." Gerarde declares the roots of "*Mede S* to be "very hurtfull to the stomacke."

Wedel published in 1718, an essay *De Colchico veneno d pharmaco,*[3] in which, to show the great disfavour in which this pla been held, he remarks,—"hactenus . . velut infame habitum et dam fuit colchicum, indignum habitum inter herbas medicas vel officina He further states, that in the 17th century, the corms were worn peasants of some parts of Germany as a charm against the plagu

In the face of these severe denunciations, it is strange to fin in the London Pharmacopœia of 1618 (the second edition), "*Colchici,*" as well as *Hermodactylus,* is enumerated among the drugs; and again in the editions of 1627, 1632 and 1639. It is o in that of 1650, and does not reappear in subsequent editions until when owing to the investigations of Störck (1763), Kratochwill (De Berge (1765) Ehrmann (1772), and others, the possibility of em ing it usefully in medicine had been made evident.

Development of the Corm[4]—At the period of flowering corm is surrounded with a brown, closed double membrane or which is prolonged upwards into a sheath around the flowering- at the base of the corm is a tuft of simple roots. On removin membranes, we find a large, ovoid, fleshy body (Corm No. 1), mar

[1] His description is exact, except that he declares the corm to have a *sweet* taste, which seems not true for *Colchicum autumnale,* but may be so for some other species.

[2] Anvers, 4to. p. 228.

[3] Jena, 4to.

[4] The term *corm* is applied by l writers to the short, fleshy, bulb- base of an annual stem, either later *Colchicum,* or terminal as in *Croc* many continental botanists, the c *Colchicum* is regarded either as a f tuber, or of bulb.

ex by a depressed scar, the point of attachment of the flower-stem
previous year; it is on one side flattened, and traversed by a
w longitudinal furrow, from the upper part of which arises a much
r and rudimentary corm (No. 2), bearing a flower-stem. After the
ction of the flower in the autumn, Corm No. 2 increases in size,
ing up as spring advances, its fruit-stem and leaves, and acquires
these latter have come to maturity, its full development. Corm
on the other hand, having performed its functions, shrivels and
ishes in size, in proportion as No. 2 advances to maturity, and
ately decays, leaving a rounded cicatrix, showing its point of
ment to its successor.

ollection—In England, the corms are usually dug up and brought
rket in July, at the period between the decay of the foliage and
oduction of the flower, or even after the latter has appeared. For
preparations, they are used in the fresh state. If to be dried, it is
nary to slice them across thinly and evenly with a knife, and to
e slices quickly in a stove with a gentle heat; the membranes are
ards removed by sifting or winnowing.

hroff has stated as the result of his experiments,[1] that the corms
s the greatest medicinal activity when collected in the autumn
or after inflorescence; that they ought to be dried *entire*, by
ure to the sun and air; and that if thus preserved, they lose
of their strength, even if kept for several years.

escription—The fresh corm is conical or inversely pear-shaped,
2 inches long by an inch or more wide, rounded on one side,
on the other, covered by a bright brown, membranous skin, within
is a second of paler colour. When cut transversely, it appears
firm, fleshy and homogeneous, abounding in a bitter, starchy juice,
greeable odour. The dried slices are inodorous, and have a bitterish
They should be of a good white, clean, crisp and brittle,—not
y or stained.

icroscopic Structure—The outer membrane is formed of tan-
lly-extended cells, with thick brownish walls; the main body of
rm, of large thin-walled, more or less regularly globular cells, loaded
starch, and interrupted by vascular bundles containing spiral
s. The original form of the starch granules is globular or egg-
d, but from mutual pressure and agglutination, many are angular
ncated. A large proportion are more or less compound, con-
of several granules united into one. In all, the hilum is very
t, appearing in some as a mere point, but in most as a line
.

emical Composition—The corms contain *Colchicin* (see next
), about 10 per cent. of starch, besides sugar, gum, resin, tannin,
t. When sliced and dried, they lose about 70 per cent. of water.[2]
ying, the (probably) volatile body upon which the odour of the
corm depends, is lost.

ses—Colchicum is much prescribed in cases of gout, rheumatism,
and cutaneous maladies.

[1] *Österreichische Zeitschrift für praktische Heilkunde*, 1856, Nos. 22–24; also Wiggers, *Bericht der Pharm.* 1856. 15.

[2] This is the average obtained during ten years in drying 16 cwt., in the laboratory of Messrs. Allen and Hanburys, London.

native of the Levant. But one can hardly suppose this pl
source of the hermodactyls (*Súrinján*) of the Indian bazaa
stated to be brought from Kashmír.

SEMEN COLCHICI.

Colchicum Seed; F. *Semence de Colchique*; G. *Zeitlose*

Botanical Origin—*Colchicum autumnale* L., see pag
inflated capsule, which grows up in the spring after the disa
the flower in the autumn, is three-celled, dehiscent towards
its ventral sutures, and contains, attached to the inner angle o
numerous globular seeds, which arrive at maturity in the
the summer.

History—Colchicum seeds were introduced into medica
Dr. W. H. Williams, of Ipswich, about 1820, on the ground o
more certain in action than the corm.[3] They were admitted t
Pharmacopœia in 1824.

Description—The seeds are of globose form, about $\frac{1}{10}$
in diameter, somewhat pointed by a strophiole, which whe
very evident. They are rather rough and dull; when rece
brown, but become darker by drying, and at the same time
of saccharine matter. They are inodorous even when fresh
bitter acrid taste; they are very hard and difficult to powde

Microscopic Structure—The reticulated, brown coat
consists of a few rows of large, thin-walled, tangentially-ex
considerably smaller towards the interior, the outermost conta

med *Colchicin*, is said to amount to only about 0·05 per cent.; but the emists who have made it the subject of investigation are not agreed as its properties. Thus Oberlin (1856) showed it to contain nitrogen, t without possessing basic properties. By treatment with acids, the orphous colchicin yields a crystallizable body, *Colchiceïn*. Hübler 864) assigned to the latter, acid qualities and, strangely enough, the same mula he gave for colchicin itself, namely, $C^{17}H^{19}NO^{6}$. Maisch[1] as ll as Diehl[2] again obtained discrepant results, and it seems probable at *Colchicin* of definite composition has not yet been isolated.

The seeds contain traces of gallic acid, sugar and fatty oil. Of the t, we obtained 6·6 per cent. by exhausting the dried seed with ether. e oil concreted at – 8° C.

Uses—The same as those of the corm.

SMILACEÆ.

RADIX SARSAPARILLÆ.

Radix Sarzæ vel Sarsæ; Sarsaparilla; F. *Racine de Salsepareille;* G. *Sarsaparillwurzel.*

Botanical Origin—Sarsaparilla is afforded by several plants of the us *Smilax*, indigenous to the northern half of South America, and the le of Central America as far as the southern and western coast-lands Mexico.

These plants are woody climbers, often ascending lofty trees by the ng tendrils which spring from the petiole of the leaf. Their stems usually angular, armed with stout prickles, and thrown up from a woody rhizome. The medicinal species inhabit swampy tropical its, which are extremely deleterious to the health of Europeans and only be explored amid great difficulties. This circumstance taken onnexion with the facts that the plants are diœcious, that their scan- habit often renders their flowers and fruits (produced at different ons, inaccessible, and that their leaves vary exceedingly in form,[3] ains why we are but very imperfectly acquainted with the botanical es of sarsaparilla.

t is not too much to assert that the sarsaparilla plant of no district in ral America is scientifically well known. The species moreover, to the drug is assigned, have for the most part been founded upon eters that are totally insufficient, so that after an attentive study rbarium specimens, we are obliged to regard as still doubtful several plants that have been named by previous writers.

aving made these preliminary remarks, we will enumerate the s to which the sarsaparilla of commerce has been ascribed.

Smilax officinalis H.B.K.—This plant was obtained in the year by Humboldt, at Bajorque, a village on the Magdalena in New

[1] ... *Journ.* ix. (1867) 249.

[2] ... *Americ. Pharm. Assoc.* 1867. 363.

[3] common *Smilax aspera* L., of n Europe, is a plant which presents versity of foliage, that if like its congeners of Tropical America, it were known only by a few leafy scraps preserved in herbaria, it would assuredly have been referred to several species.

Granada. The specimens, comprising only a few imperfe which we have examined in the National Herbarium of Pari materials upon which Kunth founded the species. Humboldt[1] s quantities of the root are shipped by way of Mompox and Car Jamaica and Cadiz.

In 1853, this plant was again gathered at Bajorque by th Warszewicz, who sent to one of us (H.) leaves and stem panied by the root, which latter agrees with the *Jamaica Sa* of commerce. But at Bajorque, the root is no longer coll exportation.

The same botanical collector, at the request of one of us, ol the year 1851, on the volcano and Cordillera of Chiriqui in C fruits, leaves, stems, and roots, of the plant there collected by th as *Sarsa peluda* or *Sarson*. These specimens agree, so far as co is possible, with those of the Bajorque plant, while the root is guishable from the Jamaica sarsaparilla of the shops. Other s of the same plant, gathered by the same collector in 1853, warded to England with a living root, which latter however cou made to grow.

Finally, in 1869, Mr. R. B. White obligingly communicate leaves and roots of a sarsaparilla collected at Patia in New which apparently belongs to the same species.

In the island of Jamaica, there has been cultivated for mar and of late with a view to medicinal use, a sarsaparilla plan appears to be *Smilax officinalis*. The specimens transmitted include neither flowers nor fruits ; but the leaves and square stem exactly with those of the plant collected at Bajorque. The roo light cinnamon-brown, and far more amylaceous than the *Jamaica Sarsaparilla* of commerce (see p. 645).

2. *Smilax medica* Schl. et Cham.—This species,[2] which was di in Mexico by Schiede in 1820, is without doubt the source of th parilla shipped from Vera Cruz. According to our observation a flexuose (or zigzag) stem, and much smaller foliage than *S.* the leaves, though very variable, often assume an auriculate for broad, obtuse, basal lobes.

It grows on the eastern slopes of the Mexican Andes, and is species of that region of which the roots are collected. These, to Schiede, are dug up all the year round, dried in the sun an into bundles.

Doubt and confusion hang over the other species of *Sm* have been quoted as the sources of sarsaparilla. *S. syphilitica* with flowers in a raceme of umbels, discovered on the Ca

[1] Kunth, *Synopsis Plant.* i. (1822) 278.—*Smilax officinalis* is a large, strong climber, attaining a height of 40 to 50 feet, with a perfectly square stem armed with prickles at the angles. The leaves are often a foot in length, of variable form, being triangular, ovate-oblong, or oblong-lanceolate, either gradually narrowing towards the apex or rounded and apiculate, and at the base either attenuated into the petiole, or truncate, or cordate. They are usually 5-nerved, the 3 inner nerves being prominent an an elliptic area. The flowers a umbels. A fine specimen of growing (1874) in the Royal G but has not flowered.

[2] We owe them to the kindn Kemble, Esq., who procured specimens of the root, from the garden at Castleton.

[3] Figured in Nees von Esenbe *Medicinales*, suppl. tab. 97.

ranada, and well figured by Berg and Schmidt from an specimen, appears from Pöppig's statements to yield some of rilla shipped at Pará. But Kunth states that Pöppig's plant ear Ega, is not that of Humboldt and Bonpland. Spruce, who *. syphilitica* (herb. No. 3779) in descending the Rio Negro in nformed us that the Indians in various places in the Amazon ays strenuously asserted it to be a species worthless for "*Salsa.*" *racea*, described by Poiret[1] in 1804, and figured by Martius[2] y imperfectly known. It has foliage resembling that of s, but, judging from Spruce's specimens (No. 1871) collected Negro, a *multangular* stem. It is probably the source of the *rparilla.*

ato-ovata Rich. is a doubtful plant, perhaps identical with *rgkiana* Knth., a Panama species. Pöppig alleges that its ed with that of the plant which he calls *S. syphilitica.*

hampay Ruiz, a Peruvian species, said to afford a valuable sort rilla, is practically unknown, and is not admitted by Kunth.[3]

y—Monardes[4] has recorded that sarsaparilla was first intro- eville about the year 1545, from New Spain; and a better on afterwards from Honduras. He further narrates that a cellent quality was subsequently imported from the province hat it was collected in the neighbourhood of Guayaquil, and ark hue, and larger and thicker than that of Honduras.

statements are confirmed by the testimony of earlier writers. Rodriguez de Castello Branco, commonly known as Amatus a Portuguese physician of Jewish origin, who practised chiefly as left a work (1556) recording his medical experiences and cases of successful treatment.[5] One of the latter concerns a fering from acute rheumatism, for whom he finally prescribed *la.* This drug, he explains, has of late years been brought ewly found country of Peru, that it is in long whip-like roots, om the stock of a sort of bramble resembling a vine, that the call it *Zarza parrilla*, and that it is an excellent medicine.

the same period, sarsaparilla was described by Auger Ferrier,[6] n of Toulouse, who states that in the treatment of syphilis, calls *Lues Hispanica*, it is believed to be better than either or *Lignum sanctum.* Girolamo Cardano of Milan, in a little *De radice Cina et Sarza Parilia judicium*, expresses similar Turner in the third part of his *Herball*, printed in 1568, *Salsaperilla*, to which he says new writers ascribe the same to guaiacum.

le Cieza de Leon, in his Chronicle of Peru,[7] which contains the

Encyclopédie méthodique, Bot.,

s. i. (1842 71) tab. 1.

not be supposed that *all* species re capable of furnishing the are many, even South Ame- like the *S. aspera* of Europe, *ica* roots, which would never cinal sarsaparilla.

and 88 of the work quoted at 5.

um medicinalium centuriæ quatuor, Basileæ, 1556. 365.

[6] *De Pudendagra lue Hispanica, libri duo*, first published at Toulouse in 1553, and many times reprinted. We have consulted the Antwerp edition of 1564, with which Cardano's work is printed. The latter is said to have first appeared in 1559.

[7] *Parte primera de la Chronica del Peru*, Sevilla, 1553. folio lxix.- a translation for the Hakluyt Society in 1864, by Markham, who observes that Cieza de Leon never himself visited Guayaquil.

observations made by him in South America between 1532 a gives a particular account of the sarsaparilla which grows in the of Guayaquil and the adjacent island of Puna, and recomm sudorific treatment of syphilis, exactly as pursued at the pres Gerarde,[1] who wrote about the close of the century, states s arsaparilla of Peru is imported into England in abundance.

Collection of the root—Mr. Richard Spruce, the enterprisir cal explorer of the Amazon valley, has communicated to us th ing particulars on this subject, which we give in his own graphic

"When I was at Santarem on the Amazon in 1849–50, whe derable quantities of sarsaparilla are brought in from the upper r the river Tapajóz, and again when on the Upper Rio Negro and in 1851–53, I often interrogated the traders about their criteri good kinds of sarsaparilla. Some of them had bought their Indians of the forest, and had themselves no certain test of its ness or of its excellence, beyond the size of the roots, the thickest the best price at Pará. Those who had gathered sarsaparilla f selves, were guided by the following characters:—1. Many stem root. 2. Prickles closely set. 3. Leaves thin.—The first chara (to them) alone essential, for in the species of *Smilax* that have stems, or not more than two or three, the roots are so few as n worth grubbing up; whereas the multicaul species have numer roots,—three at least to each stem,—extending horizontally on

"In 1851, when I was at the falls of the Rio Negro, which are by the equator, nine men started from the village of St. Gabriel t *Salsa*, as they called it, at the head of the river Cauaburís. Duri absence I made the acquaintance of an old Indian, who told four years ago he had brought stools of *Salsa* from the Cauaburís planted them in a *tabocál*,—a clump of bamboos, indicating th an ancient Indian village,—on the other side of the falls, wh invited me to go and witness the gathering of his first crop of ro the 23rd March, I visited the *tabocál*, and found some half-doz of a *Smilax* with very prickly stems, but no flowers or fruit. request the Indian operated on the finest plant first. It had n from the crown, and numerous roots about 9 feet long, radiat zontally on all sides. The thin covering of earth was first scra from the roots by hand, aided by a pointed stick; and had the the only plant occupying the ground, the task would have been the roots of the *salsa* were often difficult to trace among those and other plants, which had to be cut through with a knife whe came in the way. The roots being at length all laid bare—(in th was the work of half a day, but with large plants it sometimes ta whole day or even more)—they were cut off near the crown, a fe ones being allowed to remain, to aid the plant in renewing its gro stems also were shortened down to near the ground, and a little dead leaves heaped over the crown, which would soon shoot out

"The yield of this plant, of four years' growth, was 16 lb.— Portuguese *arroba*—of roots; but a well-grown plant will aff first cutting from one to two arrobas. In a couple of years may be cut again, but the yield will be much smaller and the slender and less starchy."

[1] *Herball*, enlarged by Johnson, 1636. 859.

General Description—The medicinal species of *Smilax* have a thick, ort, knotty rhizome, called by the druggists *chump*, from which grow a horizontal direction, long fleshy roots, from about the thickness of a ill to that of the little finger. These roots are mostly simple, forked only wards their extremities, beset with thread-like branching rootlets of arly uniform size, which however are not emitted to any great extent on the more slender part of the root near the stock. When fresh, the ot is plump,[1] but as found in commerce in the dried state, it is more or s furrowed longitudinally, at least in the vicinity of the rhizome. When amined with a good lens, both roots and rootlets may be seen in some ecimens to be clothed with short velvety or shaggy hairs.

The presence or absence in greater or less abundance, of starch in the rk of the root, is regarded as an important criterion in estimating the od quality of sarsaparilla. In England, the non-amylaceous or non-aly roots are preferred, they alone being suitable for the manufacture the dark fluid-extract that is valued by the public. On the Continent, l especially in Italy, sarsaparilla which when cut exhibits a thick k, pure white within, is the esteemed kind.

The more or less plentiful occurrence of starch in the roots of *Smilax* a character which has no great botanical significance, and appears, leed, to vary in the same species. If one examines Jamaica sarsapa-a by shaving off a little of the bark, one finds the large majority of ts to be non-amylaceous in their entire length; but others can be ked out which, though non-amylaceous for some distance from the zome, acquire a starchy bark, which is *white* internally in their middle l lower portions;—and there are still others which are slightly starchy n as they start from the parent rhizome, becoming still more so as y advance. In Guatemala sarsaparilla, which is considered a very aly sort, it is easy to perceive that the bark is hardly amylaceous in vicinity of the rhizome, but that it acquires an enormous deposit of ala as it proceeds in its growth.

Sarsaparilla varies greatly in the abundance of rootlets, technically ed *beard*, with which the roots are clothed. This character depends ly on natural circumstances, and partly on the practice of the col-ors who remove or retain the rootlets at will. Dr. Rhys of Belize stated that the proportion of rootlets depends much on the nature of soil, their development being most favoured by moist situations.

Dry sarsaparilla has not much smell, yet when large quantities are sd, or when a decoction is evaporated, a peculiar and very perceptible ar is emitted. The taste of the root is earthy and not well marked, even a decoction has no very distinctive flavour.

Microscopic Structure—On a *transverse section* of the root, its -vascular bundles are seen to be restricted to the central part, being nclosed by a brown ring. Within this ring, the bundles are densely ed so as to form a ligneous zone. The very centre of the section sts of white medullary tissue, through which sometimes a certain ber of fibro-vascular bundles are scattered. A similar medullary nchyme is met with between the brown ring or nucleus sheath and pidermis. On a *longitudinal section*, the latter exhibits several rows

[1] We have been kindly permitted to examine the fresh root of the large plant of *officinalis* in the Royal Gardens, Kew; and have found that it agrees in appearance and in structure with Jamaica sarsaparilla.

of elongated cells, having their outer brown walls thickened by secondar deposits. The brown nucleus sheath, on the other hand, consists of onl one row of prismatic cells, their inner and lateral walls alone havin secondary deposits. The vascular bundles contain large scalarifor vessels and lignified prosenchymatous cells.

The parenchymatous cells, if not devoid of solid contents, are loade with large compound starch granules; some cells also exhibit bundles o acicular crystals of calcium oxalate. In non-mealy sarsaparilla, th vessels and ligneous cells sometimes contain a yellow resin.

The various sorts of sarsaparilla differ, not only in being mealy o non-mealy, but also as regards the thickness of the ligneous zone, whic in some of them is many times thinner than the diameter of the central medullary tissue. In other kinds, this diameter is very much smaller. Yet the nucleus sheath affords still better means for distinguishing the sorts of this drug, if we examine its single cells in a transverse section. The outline of such a cell may be of a square or somewhat rounded shape, or it may be more or less extended. In this case it may be extended in the direction of a radius, or in the direction of a tangent. The secondary deposits may vary in thickness.

Sorts of Sarsaparilla—In the present state of our knowledge, no botanical classification of the different kinds of sarsaparilla being possible, we shall resort to the arrangement adopted by Pereira and place them in two groups,—the *mealy* or those of which starch is a prevalent constituent, and the *non-mealy* or those in which starch exists to a comparatively small extent.

(A). *Mealy Sarsaparillas.*

1. *Honduras Sarsaparilla*—This drug is exported from [illegible] It is made up in hanks or rolls, about 30 inches long and 2½ to 4 inches or more in diameter, closely wound round with a long root so as to form a neat bundle. The hanks are united into bales by large pieces of [illegible] placed at top and bottom, and held together with thongs of the same, further strengthened with iron hoops.

The roots are deeply furrowed, or sometimes plump and smooth [illegible] or less provided with *beard* or rootlets. In a very large proportion of their length, they exhibit when cut, a thick bark loaded with starch, yet in those parts which are near the rhizome, the bark is brown, resinous and non-amylaceous. They are of a pale brown, sometimes verging to orange. But the drug is subject to great variation, so that it is impossible to lay down absolutely distinctive characters.

The annual imports into the United Kingdom of sarsaparilla from British Honduras during the five years ending with 1870, averaged [illegible] 52,000 lb.

2. *Guatemala Sarsaparilla*—This sort of sarsaparilla, which appeared in commerce about 1852, resembles the Honduras sort in many of its characters and is packed in a similar manner. But it has a more decided *orange hue*; the roots as they start from the rhizome are lean, shrunken and but little starchy, but they become gradually stouter ($\frac{3}{10}$ inch diam.) and acquire a thick bark which is internally very white and mealy. There is a tendency in the bark of this sarsaparilla to crack and split off, so that bare spaces showing the central woody column are not unfrequent.

According to Bentley,[1] who examined specimens of the plant, this drug is derived from *Smilax papyracea*; we are not prepared to agree in this opinion.

3. *Brazilian, Pará or Lisbon Sarsaparilla*—Though formerly held in high esteem, Brazilian sarsaparilla is not now appreciated in England, and is rarely seen in the London market.[2] It is packed in a very distinctive manner, the roots being tightly compressed into a cylindrical bundle, 3 feet or more in length and about 6 inches in diameter, firmly held together by the flexible stem of a bignoniaceous plant, closely wound round them, the ends being neatly shaved off.

(B). *Non-mealy Sarsaparillas.*

4. *Jamaica Sarsaparilla*—To the English druggist this is the most important variety; it is that which appears to have the greatest claim to possess some medicinal activity, and it is the only sort admitted to the *British Pharmacopœia*. Although constantly called *Jamaica Sarsaparilla*, it is well known that it only bears the name of Jamaica through having been formerly shipped from Central America by way of that island.[3] At the commencement of the last century, Jamaica was an emporium for sarsaparilla, great quantities of which, according to Sloane,[4] were brought thither from Honduras, New Spain and Peru. Its actual place of growth, according to De Warszewicz (1851), is the mountain range known as the Cordillera of Chiriqui, in that part of the isthmus of Panama adjoining the republic of Costa Rica: here the plant grows at an elevation of 4000 to 8000 feet above the level of the sea. The root is brought by the natives to Boca del Toro on the Atlantic coast for shipment.

The drug consists of roots, 6 feet or more in length, bent repeatedly so as to form bundles about 18 inches long, and 4 in diameter, which are secured by being twined round (but less trimly and closely than the Honduras sort) with a long root of the same drug. The rhizome is entirely absent, but the fibre or beard is preserved, and is reckoned a valuable portion of the drug. The roots are deeply furrowed, shrunken, and generally more slender than in the Honduras kind; the bark when scraped off with a penknife is seen to be brown, hard and non-mealy throughout. Yet it is by no means uncommon to find roots which have smooth bark rich in starch. In colour, Jamaica sarsaparilla varies from pale earthy brown to a deeper more ferruginous hue, the latter tint being the most esteemed.

The sarsaparilla referred to at p. 640 as grown in the island of Jamaica, is a well-prepared drug, yet so pale in colour and so amylaceous, that it has but little favour in the English market. There were exported of it from Jamaica in 1870, 1747 ℔.; in 1871, 1290 ℔.[5]

5. *Mexican Sarsaparilla*—The roots of this variety are not made into bundles, but are packed in straight lengths of about 3 feet into bales,

[1] *Pharm. Journ.* xii. (1853) 470, with figure.

[2] We noticed 66 rolls of it from Pará, offered for sale 15 Dec. 1853.—D. H.

[3] The connexion between Jamaica and Central America dates back from the time of Charles II., during whose reign (1661-85), the cession of the Mosquito Territory, a district never conquered by the Spaniards, applied to the governor of Jamaica for protection, which was accorded. The protectorate lasted until 1860, when Mosquitia was ceded to the government of Nicaragua.

[4] *Nat. Hist. of Jamaica*, i. (1707), introduction p. lxxxvi.

[5] *Blue Books—Island of Jamaica* for 1870 and 1871.

roots having been obtained from a single stock.

Guayaquil sarsaparilla differs considerably from the sorts noticed. It is rudely packed in large bales, and is not gene into separate hanks. The rhizome (chump) and a portion c are often present, the latter being *round* and not prickly. ' dark, large and coarse-looking, with a good deal of fibre. T furrowed, rather thick, and not mealy in the slenderer porti root which is near the rootstock; but as the root becomes s bark becomes smoother, thicker and amylaceous, exhibiting ' fawn-coloured or pale yellow interior.

The quantity exported from Guayaquil in 1871, was 101' value £3814.[2]

Chemical Composition—Galileo Pallotta, about the first succeeded in obtaining from sarsaparilla a peculiar princ he believed to be an alkaloid, and termed *Pariglina*, or as n *Parillin*. He exhausted the crude drug with boiling water the decoction with milk of lime, whereby a greyish precipita duced. This was dried, and treated with hot alcohol whicl the parillin. Pallotta says the substance slightly reddens l does not explicitly state whether he got it in crystals or not. however to agree with the body which other chemists obtain lized, and which was called *Salseparin* by Thubeuf in 1831 *Acid* by Batka in 1833, and *Smilacin* by others.

We have isolated parillin by exhausting Mexican sarsap boiling spirit of wine, and evaporating the tincture. The bro after repeated treatment with alcohol and charcoal, afford which we purified by re-crystallization from spirit of wine. \ it from the knotty rhizomes. The process in this case was th The rhizomes coarsely powdered were exhausted by wate

in forms colourless acicular crystals, soluble in 1200 parts of 20° C., and much more abundantly in hot water. The solutions l, and froth when shaken. Parillin at 25° C. requires 25 parts l, sp. gr. 0·814, for solution; the latter is of a persistently acrid devoid of rotatory power. In warm concentrated sulphuric lin turns reddish brown, and on addition of stannous chloride fine violet hue. Parillin is insoluble in ether and nearly so orm. Its hot aqueous solution is capable of separating a little xide from an alkaline solution of tartrate of copper; if parillin for several days with dilute sulphuric acid, the liquid after en duly neutralized, exhibits an increased reducing power; we been able, however, to ascertain that in this process there is ation of sugar. According to the researches of Klunge at 874) being carried on in the laboratory of one of us (F.), the f parillin is nearly $C^{15}H^{26}O^5+3H^2O$. At 100° C., the sub- s $3H^2O$.

iling parillin with moderately dilute sulphuric acid (about r.) or with concentrated hydrochloric acid, Klunge obtained scaly crystals of a body which we call *Parigenin*. Its compo- pears nearly to answer to the formula, $C^{14}H^{24}O^2+H^2O$. But is well marked as a distinct substance from parillin by the characters:—it is less soluble in water; it requires for solution of alcohol, sp. gr. 0·814; its solutions do not froth, nor have acrid taste. With warm concentrated sulphuric acid, parigenin ellow solution, which is not altered by stannous chloride, but greenish fluorescence. Parigenin, unlike parillin, is freely ether or chloroform; it is energetically acted upon by acetyl -not so parillin. We cannot regard the above formulæ as settled; perhaps the formation of parigenin is due to or with the elimination of water. Parigenin may also be obtained y heating with concentrated sulphuric or hydrochloric acid, the lution, obtained in the process for making parillin.

resence in sarsaparilla of starch, resin, and calcium oxalate, as y the microscope, has been already pointed out. Pereira[1] the *essential oil*, which is heavier than water and has the odour of the drug; 140 ℔. of Jamaica sarsaparilla afforded of it only s.

ature of the dark extractive matter which water removes from n abundance, and the proportion of which is considered by a criterion of goodness, has not been studied.

nerce—The importation of sarsaparilla into the United King- 870 (later than which year we have no returns) amounted to ., valued at £26,564.

—Sarsaparilla is regarded by many as a valuable alterative but by others as possessing little if any remedial powers. It ich employed, though by no means so extensively as a few The preparations most in use, are those obtained by a pro- iling of the root in water.

[1] *Elements of Mat. Med.* ii. (1850) 1168.

TUBER CHINÆ.

Radix Chinæ; China Root; F. *Squine;* G. *Chinawurzel.*

Botanical Origin—*Smilax China* L. (*S. ferox* Wallich), a v thorny, climbing shrub, native of China and Japan, also of E India, as Nepal, Khasia, Sikkim, and Assam, is commonly said to this drug. The chief authority for this statement is Kämpfer, who f the plant in his *Amœnitates* in 1712, and whose specimen is stil served in the British Museum.

S. glabra Roxb. and *S. lanceæfolia* Roxb., natives of Indi Southern China, have tubers which, according to Roxburgh, cam distinguished from the China root of medicine, though the plan perfectly distinct in appearance from *S. China*. Dr. Hance,[1] of Wha received a living specimen of China root, which proved to be t *S. glabra*. The three above-named species all grow in the isla Hongkong.

History—The use of this drug as a remedy for syphilis was known to the Portuguese at Goa by Chinese traders about A.D. Garcia d'Orta, who makes this statement, further narrates that so was the reputation of the new drug, that the small quantities brought to Malacca were sold at the rate of 10 crowns per ge weight of 24 ounces.

The reported good effects of China root on the Emperor Char who was suffering from gout, acquired for the drug a great celebri Europe, and several works[2] were written in praise of its virtues. though its powers were soon found to have been greatly over-rat still retained some reputation as a sudorific and alterative, and much used at the end of the 17th century in the same way as sarsapa It still retains a place in some modern pharmacopœias.

Description—The plant produces stout fibrous roots, here and thickened into large tubers, which when dried become the drug C root. These tubers as found in the market, are of irregularly cylind form, usually a little flattened, sometimes producing short kn branches. They are from about 4 to 6 or more inches in length, 1 to 2 inches in thickness, covered with a rusty-coloured, n shining bark, which in some specimens is smooth and in others r or less wrinkled. They have no distinct traces of rudimentary le which however are perceptible on those of some allied species. S still retain portions of the cord-like woody runners on which they g the bases of a few roots can also be observed. The tubers mostly s marks of having been trimmed with a knife.

China root is inodorous and almost insipid. A transverse sec exhibits the interior as a dense granular substance of a pale fawn col

Microscopic Structure—The outermost cortical layer is made of brown, thick-walled cells, tangentially extended. They end

[1] Trimen's *Journ. of Bot.* i. (1872) 102. —*S. glabra* and *S. lanceæfolia* have been figured by Seemann in his *Botany of the Herald*, 1852–57, tabb. 99–100. *S. China* is well represented in the Kew Herbarium, where we have examined specimens from Nagasaki, Hakodadi, and Yokohama; from Loochoo, Corea, Formosa, Ningpo; and Indian ones from Khasia, Assam, Nepal.

[2] The earliest of which is by Ar Vesalius, *Epistola rationem, modumque pinandi radicis* Chynæ *decocti, quo invictissimus Carolus V. imperator usu* Venet. 1546.

tufts of needle-shaped crystals of calcium oxalate, and reddish sses of resin. The bark is at once succeeded by the inner .e which contrasts strongly with it, consisting of large, thin-ous cells which are completely gorged with starch, but here :ontain colouring matter and bundles of crystals. The starch :e large (up to 50 mkm.), spherical, often flattened and angular al pressure. Like those of colchicum, they exhibit a radiate :y frequently they have burst and run together, probably in :e of the tubers having been scalded. The vascular bundles hrough the parenchyme, contain usually two large scalariform ted vessels, a string of delicate thin-walled parenchyme, and od-cells with distinct incrusting layers and linear pores.

.cal Composition—The drug is not known to contain any .o which its supposed medicinal virtues can be referred. We ıvoured to obtain from it *Parillin*, the crystalline principle of ı, but without success.

ıerce—China root is imported into Europe from the South of ually from Canton. The quantity shipped from that port in only 384 peculs (51,200 lb.); while the same year there was om Hankow, the great trading city of the Yangtsze, no less 8 peculs (1,367,733 lb.), all to Chinese ports.[1]

-Notwithstanding the high opinion formerly entertained of ; of China root, it has in England fallen into complete disuse. and India, it is still held in great esteem for the relief of and syphilitic complaints, and as an aphrodisiac and demulcent. erts that the tubers of *Smilax* are consumed as food by ; and Mongols.[2]

ıtutes—Several American species of *Smilax* furnish a drug 'arious times has been brought into commerce as *Radix Chinæ* s. Of the exact species it is difficult to speak with certainty: *udo-China* L. and *S. tamnoides* L., growing in the United n New Jersey southward; *S. Balbisiana* Kuth, a plant common West Indian Islands; and *S. Japicanga* Griseb., *S. syringoides* d *S. Brasiliensis* Spreng., are reputed to afford large tuberous which in their several localities, replace the China root of Asia, nployed in a similar manner.

GRAMINEÆ.

SACCHARUM.

, *Cane Sugar, Sucrose*; F. *Sucre, Sucre de canne*; G. *Zucker, Rohrzucker.*

ıical Origin—*Saccharum officinarum* L., the Sugar Cane. d stem is from 6 to 12 feet high, solid, hard, dense, internally

of Trade at the Treaty Ports in 872, pp. 34, 154.

.e this statement with reserve, .t both Chinese and Europeans onfound China root with the oid production termed *Pachyma* first is called in Chinese *Tu-fuh-ling*, -the second *Fuh-ling* or *Po-fuh-ling*. *Pharm. Journ.* iii. (1862) 421; F. Porter Smith, *Mat. Med. and Nat. Hist. of China*, 1871. 198; Dragendorff, *Volksmedicin Turkestans* in Buchner's *Repertorium*, xxii. (1873) 135.

juicy, and hollow only in the flowering tops. e al varieties ar tivated, as the *Country Cane*, the original form or t species; the l *Cane*, with purple or yellow stripes along the stem; the *Bourl Tahiti Cane*, a more elongated, stronger, more hairy and very prod variety. *Saccharum violaceum* Tussac, the *Batavian Cane*, is als sidered to be a variety; but the large *S. Chinense* Roxb. introduce Canton in 1796 into the Botanic Gardens of Calcutta, may be a d species; it has a long, slender, erect panicle, while that of *S. offici* is hairy and spreading, with the ramifications alternate and mor pound, not to mention other differences in the leaves and flowers.

The sugar cane is cultivated from cuttings, the small seed seldom ripening. It succeeds in almost all tropical and subt countries, reaching in South America and Mexico an elevation the sea of 5000–6000 feet. It is cultivated in most parts of Indi China up to 30–31° N. lat., the mountainous regions excepted.

From the elaborate investigations of Ritter,[1] it appears that *S rum officinarum* was originally a native of Bengal, and of the Chinese countries, as well as of Borneo, Java, Bali, Celebes, and islands of the Malay Archipelago. But there is no evidence that now found anywhere in a wild state.

History—The sugar cane was doubtless known in India from immemorial, and grown for food as it still is at the present day, c in those regions which are unsuited for the manufacture of sugar.[2]

Herodotus, Theophrastus, Seneca, Strabo, and other early w had some knowledge of raw sugar, which they speak of as the *Ho Canes* or *Honey made by human hands*, not that of bees; but it w until the commencement of the Christian era, that the ancients n fested an undoubted acquaintance with sugar, under the name of *charon*.

Thus Dioscorides[3] about A.D. 77, mentions the concreted honey c Σάκχαρον found upon canes (ἐπὶ τῶν καλάμων) in India and A Felix, and which in substance and brittleness resembles salt. I evidently knew the same thing under the name *Saccharum*; and author of the Periplus of the Erythrean Sea, A.D. 54–68, states that h from canes, called σάκχαρι, is exported from Barygaza, in the Gu Cambay, to the ports of the Red Sea, west of the *Promontorium A tum*, that is to say to the coast opposite Aden. Whether at that p sugar was produced in Western India, or was brought thither from Ganges, is a point still doubtful.

Bengal is probably the country of the earliest manufacture of s hence its names in all the languages of Western-Asiatic and Eur nations are derived from the Sanskrit *Sharkará*, signifying a substan the shape of small grains or stones. It is strange that this word con no allusion to the *taste* of the substance.

Candy, as sugar in large crystals is called, is derived from the A *Kand* or *Kandat*, a name of the same signification. An old Sa

[1] *Erdkunde von Asien*, ix. West-Asien, Berlin, 1840. pp. 230–291.

[2] The production which the English translators of the Bible have rendered *Sweet Cane*, and which is alluded to by the prophets Isaiah (ch. xliii. 24) and Jeremiah (ch. vi. 20) as a commodity imported from a distant country, has been the sub much discussion. Some have supp be the sugar cane; others, an aromat (*Andropogon*). In our opinion, there reason to conclude that it was *Cassi*

[3] Lib. ii. c. 104.

'entral Bengal is *Gura*, whence is derived the word *Gula*, *iw sugar*, a term for sugar universally employed in the rchipelago, where on the other hand they have their own he sugar cane, although not for sugar. This fact again speaks of Ritter's opinion, that the preparation of sugar in a dry state is due to the inhabitants of Bengal. Sugar under the *i-mi*, i.e. *Stone-honey*, is frequently mentioned in the ancient nals among the productions of India and Persia; and it is at the Emperor Tai-tsung, A.D. 627–650, sent an envoy to the Magadha in India, the modern Bahar, to learn the method turing sugar.[1] The Chinese, in fact, acknowledge that the ween A.D. 766 and 780 were their first teachers in the art of ;ar, for which they had no particular ancient written character. bian writer, Abu Zayd al Hasan,[2] informs us that about A.D. ugar cane was growing on the north-eastern shore of the lf; and in the following century, the traveller Ali Istakhri[3] r abundantly produced in the Persian province of Kuzistan, Susiana. About the same time (A.D. 950), Moses of Chorene, in, also stated that the manufacture of sugar was flourishing lebrated school of medicine at Jondisabur in the same province, is of this industry in the shape of millstones, &c. still exist s.

physicians of the 10th and 11th centuries, as Rhazes, Haly . Avicenna, introduced sugar into medicine. The Arabs cul- sugar cane in many of their Mediterranean settlements, as ily, Italy, Northern Africa and Spain. The Calendar of Cor- s that as early as A.D. 961, the cultivation was well under- ain, which is now the only country in Europe where sugar xist.[5]

n II., King of Sicily, presented in A.D. 1176 to the convent of mills for grinding cane, the culture of which still lingers at Syracuse, though only for the sake of making rum. In 1767, lantations and sugar houses at this spot were described by a is "worth seeing."

the middle ages, England in common with the rest of Northern as supplied with sugar from the Mediterranean countries, Egypt and Cyprus. It was imported from Alexandria as early l of the 10th century by the Venetians, with whom it long an important article of trade. Thus we find[7] that in A.D. nerchant of Venice, Tommaso Loredano, shipped to London of sugar, the proceeds of which were to be returned in *wool*, iat period constituted the great wealth of England. Sugar ery dear: thus from 1259 to 1350, the average price in Eng- about 1s. per lb., and from 1351 to 1400, 1s. 7*d*.[8] In France same period, it must have been largely obtainable, though expensive. King John II. ordered in 1353, that the apothe-

ider, *Chinese Botanical Works*,

. 286.

Lander, translated by Mordt- urg, 1845. 57.

drier de Cordoue de l'année Dozy, Leyde, 1873. 25. 41. 91.

[5] There are several in the neighbourhood of Malaga.

[6] Riedesel, *Travels through Sicily*, Lond. 1773. 67.

[7] Marin, *Commercio de' Veneziani*, v. 306.

[8] Rogers, *Hist. of Agriculture and Prices in England*, i. (1866) 633. 641.

caries of Paris should not use honey in making those confectio ought to be prepared with the good white sugar called *cafetin*.[1]

The importance of the sugar manufacture in the East was w in the latter half of the 13th century by Marco Polo;[2] and in Barbosa and other European travellers; and the trading nations o rapidly spread the cultivation of the cane over all the countries, the climate was suitable. Thus, its introduction into Madeira g as far as A.D. 1420; it reached St. Domingo in 1494,[3] the Canary in 1503, Brazil in the beginning of the 16th century, Mexico abo Guiana about 1600, Guadaloupe in 1644, Martinique in 1650,[4] M towards 1750, Natal[5] and New South Wales[6] about 1852, whil very early period, the sugar cane had been propagated from th Archipelago over all the islands of the Pacific Ocean.

The ancient cultivation in Egypt, probably never quite ext been revived on an extensive scale by the present viceroy, Ismai There were 13 sugar factories, making raw sugar, belonging Egyptian government at work in 1872, and about 100,000 acres devoted to sugar cane. The export of sugar from Egypt in 1872, 2 millions of *kantars* or about 89,200 tons.[7]

The imperfection of organic chemistry previous to the middl 18th century, permitted no exact investigations into the chemica of sugar. Marggraf of Berlin[8] proved in 1747, that sugar o many vegetables, and succeeded in obtaining it in a pure cry state from the juice of beet-root. The enormous practical impor this discovery did not escape him, and he caused serious attemp made for rendering it available, which were so far successful t first manufactory of beet-sugar was established in 1796 by A Kunern in Silesia.

This new branch of industry[9] was greatly promoted by the p tive measures, whereby Napoleon excluded colonial sugar from the whole Continent; and it is now carried forward upon such a sc 640,000 to 680,000 tons of beetroot sugar are annually produced in the entire production of cane sugar being estimated at 1,260 1,413,000 tons.[10]

Among the British colonies, Mauritius, British Guiana, T Barbados, and Jamaica produce at present the largest quantity of

Production—No crystals are found in the parenchyme of th the sugar existing as an aqueous solution, chiefly within the cells centre of the stem. The transverse section of the cane exhibits nu fibro-vascular bundles, scattered through the tissue, as in other n tyledonous stems; yet these bundles are most abundant towa

[1] *Ordonnances des rois de France*, ii. (1729) 535.

[2] Yule, *Book of Ser Marco Polo*, ii. (1871) 79. 171. 180. &c.

[3] *Letters of Christ. Columbus* (Hakluyt Society) 1870. 81–84.

[4] De Candolle, *Géogr. botanique*, 836.

[5] The value of the sugar exported from Natal in 1871 reached the astonishing amount of £180,496.

[6] Yet owing to the gold discoveries, the propagation of the cane in Australia was little thought of until about 1866 or 1867, when small lots of sugar were made.

[7] Consul Rogers, *Report on the Cairo for* 1872, presented to Parlia

[8] *Expériences chymiques faites dessein de tirer un véritable sucre d plantes qui croissent dans nos cl* Mr. Marggraf, traduit du latin– *l'Académie royale des Sciences lettres*, année 1747 (Berlin 1749) 7

[9] And also that of *milk sugar*, w then much used on the Continent *rate* cane sugar.

[10] *Produce Markets Review*, 1868.

ior, where they form a dense ring covered with a thin epidermis, ı is very hard by reason of the silica which is deposited in it.[1] In entre of the stem the vascular bundles are few in number; the chyme is far more abundant, and contains in its thin-walled cells most clear solution of sugar, with a few small starch granules and tle soluble albuminous matter. This last is met with in larger ity in the cambial portion of the vascular bundles. Pectic principles ombined with the walls of the medullary cells, which however do well much in water (Wiesner).

rom these glances at the microscopical structure of the cane, the ss to be followed for obtaining the largest possible quantity of , becomes evident. This would consist in simply macerating thin of the cane in water, which would at once penetrate the paren- ıe loaded with sugar, without much attacking the fibro-vascular les containing more of albuminous than of saccharine matter. By nethod, the epidermal layer of the cane would not become saturated sugar, nor would it impede its extraction,—results which necessarily v when the cane is crushed and pressed.[2]

'he process hitherto generally practised in the colonies,—that of cting the juice of the cane by crushing and pressing,—has been rately described and criticized by Dr. Icery of Mauritius.[3] In that d, the cane, six varieties of which are cultivated, is when mature, osed of *Cellulose*, 8 to 12 per cent.; *Sugar*, 18 to 21; *Water* includ- lbuminous matter and salts, 67 to 73. Of the entire quantity of in the cane, from 70 to 84 per cent. is extracted for evaporation, yields in a crystalline state about three-fifths of the sugar which ane originally contained. This juice, called in French *resou*, has on verage the following composition :—

Albuminous matters	0·03
Granular matter (starch?)	0·10
Mucilage containing nitrogen	0·22
Salts	0·29
Sugar	18·36
Water	81·00
	100·00

irst two classes of substances render the juice turbid, and greatly ote its fermentation, but they easily separate by boiling, and the may then be kept a short time without undergoing change. In colonies the yield is said to be far inferior to what it should be; ıe juice is obtained in a state allowing of easier purification, when traction is not carried to the furthest limit.

ms of American sugar cane, dried at , yielded 4 per cent. of ash, nearly which was silica.—Popp, in Wiggers' *ericht*, 1870. 35.

e plan of obtaining a syrup by mace- he sliced fresh cane, has been tried daloupe, but abandoned owing to actical difficulties in exhausting the ıd in carrying on the evaporation of ıors with sufficient rapidity. Ex- ıts for extracting a pure syrup by means of cold water from the *sliced and dried* cane, seem to promise good results.—See a paper by Dr. H. S. Mitchell in *Journ. of Soc. of Arts*, Oct. 23, 1868.

[3] *Annales de Chimie et de Physique*, v. (1865) 350-410.—See also, for Cuba, Alvaro Reynoso, *Ensayo sobre el cultivo de la caña de Azúcar*, Madrid, 1865. 359.—For British Guiana, *Catal. of Contributions from Brit. Guiana to Paris Exhib.* 1867. pp. xxxviii.-xli.

Description and Chemical Composition—Cane s
of a numerous class of well-defined organic compoun
occurrence throughout the vegetable and animal kingdom
obtained by decomposing certain other substances; in
however, glucose or some other sugar than cane sugar, is o
sugar $C^{12}H^{22}O^{11}$ melts, without change of composition, at
other kinds of sugar giving off water, with which they fo
compounds at the ordinary temperature.

Cane sugar forms hard crystals of the oblique rhombic
a sp. gr. of 1·59. Two parts are dissolved by one part
and by much less at an elevated temperature; a slight de
thermometer is observable in the former case. One pa
solved in one of water, forms a liquid of sp. gr. 1·23; t
one of water, a liquid of sp. gr. 1·33. Sugar requires 65 p
wine (sp. gr. 0·84) or 80 parts of anhydrous alcohol for
does not act upon it.

A ray of polarized light is deviated by an aqueous s
sugar to the *right*, but by some other kinds of sugar to t
shown by Biot. These optical powers are highly importa
practical estimation of solutions of sugar, and in scienti
nected with sugar or saccharogenous substances. The op
chemical properties of sugar are altered by many circun
action of dilute acids or alkalis, or by the influence of
Yeast occasions sugar to undergo alcoholic fermentation.
set up an action by which butyric, lactic or propionic aci

Cane sugar is of a purer and sweeter taste than mos
Though it does not alter litmus paper, yet with alkalis
pounds some of which are crystallizable. From an alka

become reduced to about 93° C. Yet before undergoing these lent alterations, it assumes an amorphous condition if allowed to t with a third of its weight of water, becoming always a little ured by pyrogenous products. In the course of time however, this rphous sugar loses its transparency and reassumes the crystalline a. Like sulphur and arsenious acid, it is capable of existing either crystallized or an amorphous state.

If sugar is heated to about 190° C., water is evolved, and we obtain dark brown products commonly called *Caramel* or *Burnt Sugar*. y are of a peculiar sharp flavour, of a bitter taste, incapable of fer- iting and deliquescent. One of the constituents of caramel, *Cara- ine*, $C^{12}H^{18}O^{9}$, has been obtained by Gélis (1862) perfectly colourless. en the heat is augmented, the sugar at last suffers a decomposition mbling that which produces tar (see p. 561), its pyrogenous products ıg the same or very analogous to those of the dry distillation of wood.

Varieties of Cane Sugar—The experiments of Marggraf referred ıt p. 652, showed that cane sugar is by no means confined to the ar cane; and it is in fact extracted on an extensive scale from several er plants, of which the following deserve mention.

Beet Root—The manufacture of cane sugar from the fleshy root of ıltivated variety of *Beta maritima* L., is now largely carried on in tinental Europe and in America, and with admirable results.

Of fresh beet root, 100 parts contain on an average 80 per cent. of er, 11 to 13 of cane sugar, and about 7 per cent. of pectic and albu- ous matters, cellulose and salts. Of the total amount of juice which root contains, eight-ninths are extracted: and by the best process in practice, 8 to 9 parts of sugar from every 100 parts of fresh root. yield of crystalline sugar is still on the increase, owing to continual ovements in the mechanical and chemical parts of the process.

Palm—Several species are of great utility for the production of the : called by Europeans *Jaggery*.[1] This substance is obtained by the es of India in the following manner:—The young growing spadix, wering shoot, of the palm is cut off near its apex; and an earthen l is tied on to the stump to receive the juice that flows out. This l is emptied daily; while to promote a continuous flow of sap, a slice is cut from the wounded end. The juice thus collected, if at boiled down, yields the crude brown sugar known as *jaggery*. If ed to ferment, it becomes the inebriating drink called *Toddy* or wine; or it may be converted into vinegar. The spirit distilled toddy is *Arrack*.

: the sugar-yielding palms of Asia, *Phœnix silvestris* Roxb., which is sed to be the wild form of the date palm, is one of the more tant. The coco-nut palm, *Cocos nucifera* L.; the magnificent ra palm, *Borassus flabelliformis* L.; and the Bastard Sago, *Caryota* L., also furnish important quantities of sugar. In the Indian elago, sugar is obtained from the sap of *Arenga saccharifera* which grows there in abundance as well as in the Philippines and do-Chinese countries. It is also got from *Nipa fruticans* Thunb., of the low coast regions, extensively cultivated in Tavoy.

[1] A word of Sanskrit origin, corrupted from the Canarese, *sharkari*.

and its variety (var. *nigrum*) the Black Sugar Maple. *A.* L., *A. Negundo* L. (*Negundo aceroides* Moench.) and *A. da* are also used; the sap of the last is said to be the least s

As the juice of these trees yields not more than abou sugar, it requires for its solidification a large expenditur manufacture of maple sugar can therefore be advantageo only in countries remote from markets whence ordinar procured, or in regions where fuel is extremely plent America, it flourishes only between 40° and 43° N. la aware of any estimate of the total production of map Census of Pennsylvania of 1870, gave the following figu to its manufacture in that State:—

1850	1860	1870
2,326,525 lb.	2,768,965 lb.	1,545,917

Sorghum—Another plant of the same order as *Sorghum saccharatum* Pers. (*Holcus saccharatus* L.) a nat China,[3] which has of late been much tried as a sugar both in Europe and North America; yet without any g the purification of the sugar is accomplished with pec As in the sugar cane, there are in sorghum, crystallizable lizable sugars, the former being at its maximum amount reaches maturity. The importance of the plant how increasing on account of the value of its leaves and gr horses and cattle, and of its stems which can be employe facture of paper and of alcohol.

Commerce—The value of the sugar imported in Kingdom is constantly increasing, as shown by the follo

1868	1870

s—Refined sugar is employed in pharmacy for making syrups, ies and lozenges, and is useful not merely for the sake of ; the unpleasant taste of other drugs, but also on account of a ;tive influence which it exerts over their active constituents.

covado or Raw Sugar is not used in medicine. The dark uncrys- e syrup, known in England as *Molasses, Golden Syrup*, and *Treacle* [1] oreign pharmacy as *Syrupus Hollandicus vel communis*, which is in the preparation of pure sugar by the influence of heat, bodies, microscopic vegetation, and the oxygen of the air, is es employed for making pill-masses. The treacle of colonial ɔne is adapted for this purpose, that of beet root having a dis- e taste, and containing from 19 to 21 per cent. of oxalate, and malate of potassium, and only 56 to 64 of sugar.[2] The f colonial sugar usually contains 5 to 7 per cent. of salts.

HORDEUM DECORTICATUM.

m perlatum, Fructus vel Semen Hordei ; Pearl Barley ; F. *Orge mondé ou perlé ;* G. *Gerollte Gerste, Gerstegraupen.*

anical Origin—*Hordeum distichum* L.,—the Common or Long- ırley, is probably indigenous to western temperate Asia, but has ıltivated for ages throughout the northern hemisphere. In its cultivation extends as far as 68° 38′ N. lat. ; on the Norwegian to the Altenfjord in 70° N. lat. ; even in Lapland, it succeeds as 900 to 1350 feet above the level of the sea. In several of the Swiss Alpine valleys, barley ripens at 5000 feet, and in the a at 11,000 feet. In the Equatorial Andes, where it is exten- own, it thrives up to at least 11,000 feet above the sea. No eal can be cultivated under so great a variety of climate.

rding to Bretschneider,[3] barley is included among the five which it is related in Chinese history were sowed by the Emperor ng, who reigned about 2700 B.C. ; but it is not one of the five grain which are used at the ceremony of ploughing and sowing ınnually performed by the emperors of China.

phrastus was acquainted with several sorts of barley (Κριθή), ɔng them, with the six-rowed kind or *hexastichon*, which is the that is represented on the coins struck at Metapontum [4] in between the 6th and 2nd centuries B.C.

ɔo and Dioscorides in the 1st century allude to drinks made ley, which according to Tacitus were even then familiar to the tribes, as they are known to have been still earlier to the Greeks ptians.

ey is mentioned in the Bible as a plant of cultivation in Egypt a, and must have been, among the ancient Hebrews, an important

he word *Treacle* came to be trans- n its application to an opiate o become a name for *molasses*, we In the description of sugar- iven by Salmon in his *English or Druggist's Shop opened*, Lond. cle is never mentioned, but only "

[2] Landolt, *Zeitschr. f. analyt. Chem.* vii. (1868) 1–29.

[3] *On Chinese Botanical Works*, &c., Foochow, 1870. 7. 8.

[4] Metapontum lay in the plain between the rivers Bradano and Basento in the gulf of Taranto.

closer grinding, the whole of the integuments have been r
grain has become completely rounded, it is termed *Pearl*
British Pharmacopœia, it is this sort alone which is orde

Description—Pearl Barley is in subspherical or
grains about 2 lines in diameter, of white farinaceous asp
yellowish from remains of the adhering husk, which i
surface, as well as in the deep longitudinal furrow with
is indented. It has the farinaceous taste and odour wh
to most of the cereal grains.

Microscopical Structure—The albumen which
main portion of the grain, is composed of large thin-wal
the cells of which on transverse section, are seen to r
furrow, and to be lengthened in that direction rather tha
In the vicinity of the furrow alone, the tissue of the albu
Its predominating large cells show a polygonal or ova
the outer layer is built up of two, three or four rows
coherent, nearly cubic gluten-cells. This layer, about 7
coated with an extremely thin brown tegument, to which
about 30 mkm. thick, of densely packed, tabular, greyi
cells of very small size; this proper coat of the fruit i
of rather spongy appearance.

In some varieties of barley, the fruit is constitute
tissues alone and the shell, but in most the paleæ are
They consist chiefly of long fibrous, thick-walled cells, t
deep, constituting a very hard layer. On transverse se
forms a coherent envelope, about 35 mkm. thick; its
mined in longitudinal section, show but a small lumen o
lated outline from secondary deposits.

remely small granules of albuminous matters (gluten), which on lition of iodine, are coloured intensely yellow. These granules, which isidering barley as an article of food, are of prominent value, are confined to the gluten-cells, but the neighbouring starch-cells also tain a small amount of them: and in the narrow zone of denser ue projecting from the furrow into the albumen, protein principles are ally deposited, as shown by the yellow coloration which iodine duces.

The gluten-cells, the *membrane embryonnaire* of Mège-Mouriès, con- ı also, according to the researches on bread[1] made by this chemist 56), *Cerealin*, an albuminous principle soluble in water, which causes transformation of starch into dextrin, sugar, and lactic acid. In the ks (*épiderme, épicarpe* and *endocarpe*) of wheat, Mège-Mouriès found ıe volatile oil and a yellow extractive matter, to which, together with cerealin, is due the acidity of bread made with the flour containing bran.

Chemical Composition—Barley has been submitted to careful lyses by many chemists, more especially by Lermer.[2] The grains tain usually 13 to 15 per cent. of water; after drying, they yield to er 3 per cent. of fat oil, with insignificant proportions of tannic and er principles, residing chiefly in the husks. Lermer further found in whole grains, 63 per cent. of starch, 7 of cellulose, 6·6 of dextrin, of nitrogen, a small amount of lactic acid, and 2·4 of ash.

The analysis of Poggiale (1856) gave nearly the same composition, ıely, water 15, oil 2·4, starch 60, cellulose 8·8, albuminous principles ', ash 2·6.

The protein, or albuminous matter, consists of different principles, fly insoluble in cold water. The soluble portion is partly coagulated boiling, partly retained in solution: 2·5 per cent. of nitrogen, as re, would answer to about 16 per cent. of albuminous matters. Their ble part seems to be deposited in the starch-cells, next to the gluten- , which latter contain the insoluble portion.

The ash according to Lermer, contains 29 per cent. of silicic acid, of phosphoric acid, 22·7 of potash, and only 3·7 of lime. In the ion of Salm-Horstmar, fluorine and lithia are indispensable con- ents of barley.

The fixed oil of barley, as proved in 1863 by Hanamann, is a com- d of glycerin with either a mixture of palmitic and lauric acids, or probably with a peculiar fatty acid. Beckmann's *Hordeinic Acid* ned in 1855 by distilling barley with sulphuric acid, is probably acid. Lintner (1868) has shown barley to contain also a little *sterin* (p. 678).

arley when malted loses 7 per cent.; it then contains 10 to 12 per of sugar, produced at the expense of the starch; before malting, gar is to be found, but only dextrin.

ses—Barley as a medicine is unimportant. A decoction is some- prescribed as a demulcent or as a diluent of active remedies. An ıs extract of malt has been employed.

actually examined *wheat*, not barley; ne the chemical constitution of the us to be similar.

[2] Wittstein, *Vierteljahresschr. für prakt. Pharm* xii. (1863) 4 23.

OLEUM ANDROPOGONIS.

Oleum Graminis Indici; Indian Grass Oil.

Botanical Origin—Among the numerous species of *And* which have foliage abounding in essential oil, the following fun fragrant *Grass Oils* of commerce :—

1. *Andropogon Nardus* L.,[2]—a noble-looking plant, rising flower to a height of 6 or more feet, extensively cultivated in Ce Singapore for the production of *Citronella Oil.*

2. *A. citratus* DC.,[3] Lemon Grass,—a large coarse glauco known only in a cultivated state, and very rarely producing flo is grown in Ceylon and Singapore for the sake of its essential o is called *Lemon Grass Oil, Oil of Verbena* or *Indian Melissa O* also commonly met with in gardens throughout India and is n quent in English hothouses. In Java it is called *Sireh.*

3. *A. Schœnanthus* L.,[4] a grass of Northern and Central Indi leaves rounded or slightly cordate at the base, yielding by di the oil known as *Rúsa Oil, Oil of Ginger Grass* or *of Geranium*

History—The aromatic properties of certain species of *An* were well known to Rheede, Rumphius, and other early writers o natural history; and an oil distilled from the *Sireh* grass in *A* was known as a curiosity, as early as 1717.[5]

But it is only in very recent times that the volatile oils plants have become objects of commerce with Europe. Lemon is mentioned by Roxburgh in 1820, as being distilled in the M and it was first imported into London about the year 1832. Ci oil is of much more recent introduction. Ginger grass oil, c Hindustani, *Rúsa ka tel,* is stated by Waring[6] to have been first to notice by Dr. N. Maxwell in 1825.

Production—Citronella and Lemon grass are cultivated abo and at Singapore, the same estate often producing both. The are distilled separately, the essential oils being regarded as entir tinct, and having different market values. In Ceylon they are distillation at any time of year, but mostly in December and Jan

On the Perseverance Estate at Gaylang, Singapore, belongin John Fisher, an area of 950 acres is cultivated with aromatic gra other plants, for the production of essential oils. The manufact tried on a small scale in 1865, and has been so successful that a gate of 200 lb. of various essential oils is now produced *daily.* T

[1] Major-General Munro has at our request investigated the botanical characters of the fragrant species of *Andropogon*, and examined a numerous suite of specimens in our possession. The synonyms in foot-notes are given upon his authority.

[2] *A. Martini* Thwaites, *Enum. Plantarum Zeylaniæ* nec aliorum.

[3] *A. citratum* A.P. De Candolle, *Catalogus Plantarum Horti Botanici Monspeliensis*, 1813; *A. Schœnanthus* Wallich, *Plant. Asiat. rariores*, iii. (1832) tab. 280; Roxburgh, *Flora Indica*, i. (1820) 2 observationes, sed non quoad diag

[4] Ventenat, *Jardin de Cels*, 1 89; *A. Martini* Roxb. *Flor. In* 280; *A. pachnodes* Trinius, *Sp minum*, iii. (1836) tab. 327; *A. aromaticus* Royle, *Illustrations Himalayan Mountains*, 1839. tab

[5] *Ephemerides Naturæ Curio* v.–vi. (1717), appendix 157.

[6] *Pharmacopœia of India*, 186

tated to be Citronella, Lemon Grass, Patchouly, Nutmeg, Mace, er, and Omam (p. 269): and mint is now being cultivated.[1]

inger grass oil is distilled in the collectorate of Khandesh in the ›ay Presidency. That produced in the district of Nimár in the valley : Nerbudda, is sometimes called *Grass Oil of Nimár.* We have no :ulars of the distillation, which however must be carried on extensively.

escription—The Indian grass oils are lighter than water, devoid tatory power when examined by polarized light, and do not alter s paper. They are all extremely fragrant, having an odour like cture of lemon and rose. Lemon grass, which in colour is a golden brown, has an odour resembling that of the sweet-scented na of the gardens, *Lippia citriodora* H.B.K. Ginger grass oil, the r of which varies from pale greenish yellow to yellowish-brown, has lour of *Pelargonium Radula* Ait. The colour of citronella oil is a greenish-yellow. The manufacture of Winter of Ceylon, and of r of Singapore, have a reputation for excellence, and are generally ıted by name in drug sale catalogues.

hemical Composition—Stenhouse[2] examined in 1844, oil of r grass given to him by Christison as *Oil of Namur* (or *Nimár*). ample was of deep yellow, and apparently old, for when mixed with and subjected to distillation, it left nearly one-half its bulk of a resin, the oil which passed over being colourless. After rectification chloride of calcium, it was shown to consist of a hydrocarbon l with a small proportion of an oxygenated oil. The latter having decomposed by sodium, and the oil again rectified, a second analysis ıade which proved it isomeric with oil of turpentine.

genuine grass oil from Khandesh, derived as we suppose from the species, which was examined by one of us (F.), yielded nothing lline when saturated with dry hydrochloric acid; but when the l was afterwards treated with fuming nitric acid, crystals of the ›und, $C^{10}H^{16}$, HCl, sublimed into the upper part of the vessel. We observed that the oils both of lemon grass and citronella yield solid ›unds, if shaken with a saturated solution of bisulphite of sodium. tronella oil was found by Gladstone (1872) to be composed chiefly oxidized oil, which he called *Citronellol,* and which he separated ctional distillation into two portions, the one boiling at 202–205° C., her at 199–202° C. The sp. gr. of the first at 20° C. was 0·8749, second 0·8741. The composition of each portion is indicated by rmula, $C^{10}H^{16}O$.

›mmerce—The growing trade in grass oil is exemplified in a ıg manner by the following statistics. The export of *Citronella* ›m Ceylon in 1864, was 622,000 ounces, valued at £8230. In the ı *Blue Book,* published at Colombo last year, the exports for 1872 turned thus :—

To the United Kingdom	1,163,074	ounces
British India	5,713	,,
United States of North America . . .	426,470	,,
	1,595,257	ounces.[3]

[1] *its Settlements Blue Book for* 1872, re, 1873. 465.

[2] *. of Chem. Soc.* ii. (1845) 122.

[3] In addition to which, there were "248 *dozens and* 33 *packages*" of the same oil shipped to the United States.

[illegible] Internally, grass oil is sometimes administered as a
colic ; and an infusion of the leaves of lemon grass is pres
phoretic and stimulant. In Europe and America, the
almost exclusively by the soapmakers and perfumers.[1]

But the most remarkable use made of any grass oil, i
terating *Attar of Rose* in European Turkey. The oil th
that of *Andropogon Schœnanthus* L. (see p. 237) ; and it i
that its Hindustani name is closely similar in sound to
Thus under the designation *Rusa*, *Rowsah*, *Rosa*, *Rosé*,
exported in large quantities from Bombay to the ports
bably chiefly to Jidda, whence it is carried to Turkey b
medan pilgrims. In Arabia and Turkey, it appears u
Idris yâghi, while in the attar-producing districts of t
known, at least to Europeans, as *Geranium Oil* or *Palmar*
being mixed with attar, the oil is subjected to a certa
which is accomplished by shaking it with water acidula
juice, and then exposing it to the sun and air. By this p
described by Baur,[3] the oil loses a penetrating after-smel
a pale straw colour. The optical and chemical diffe
grass oil thus refined and attar of rose, are slight and d
small admixture of the former. If grass oil is added
it will prevent its congealing.

Adulteration—The grass oil prepared by the natives
unfrequently contaminated with fatty oil.

Other Products of the genus Andropog

Herba Schœnanthi vel Squinanthi, *Juncus od*
Camelorum.

ınd up to an elevation of 11,000 feet. Mr. Tolbort has sent us ·ns under the name of *Khárí*, gathered by himself in 1869 between and Kot Sultán, and quite agreeing with the drug of pharmacy. ıss has an aromatic pungent taste, which is retained in very old ·ns. We are not aware that it is distilled for essential oil.

ıcus or Vetti-ver [1]—This is the long fibrous root of *Andropogon* 'us Retz, a large grass found abundantly in rich moist ground in ·n India and Bengal. Inscriptions on copper-plates lately dis- in the district of Etawah, south-east of Agra, and dating from 03 and 1174, record grants of villages to Brahmins by the ' Kanauj, and enumerate the imposts that were to be levied. These taxes on mines, salt pits and the trade in precious metals, also wah (*Bassia*) and mango trees, and on *Cuscus Grass*.[2]

:us, which appears occasionally in the London drug sales, is used and for laying in drawers as a perfume. In India, it serves for *tatties* or screens, which are placed in windows and doorways, en wetted, diffuse an agreeable odour and coolness. It is also · making ornamental baskets and many small articles, and has putation as a medicine.

RHIZOMA GRAMINIS.

Graminis; Couch Grass, Quitch Grass, Dog's Grass; F. *Chiendent ommun ou Petit Chiendent;* G. *Queckenwurzel, Graswurzel.*

anical Origin—*Agropyrum repens* P. Beauv. (*Triticum repens* L.), · diffused weed, growing in fields and waste places in all parts of in Northern Asia down to the region south of the Caspian, also ı America; and in South America to Patagonia and Tierra del

tory—The ancients were familiar with a grass termed Ἄγρωστις *men*, having a creeping rootstock like that under notice. It is ·le to determine to what species the plant is referable, though it ble that the grass *Cynodon Dactylon* Pers., as well as *Agropyrum* ·as included under these names.

·corides asserts that its root taken in the form of decoction, is a ·medy in suppression of urine and vesical calculus. The same ıts are made by Pliny; and again occur in the writings of Ori- and Marcellus Empiricus[4] in the 4th, and of Aëtius[5] in the 6th and are repeated in the mediæval herbals.[6] Turner[7] and Gerarde ribe to a decoction of grass root, diuretic and lithontriptic virtues. g is still a domestic remedy in great repute in France, being a demulcent and sudorific in the form of *tisane*.

:ription—Couch-grass has a long, stiff, pale yellow, smooth

, otherwise written *Khus-khus*, a ·ted by the English in India, is rom the Persian *Khas*. *Vetti-ver* yalim name of the plant.
f Asiat. Soc. of Bengal, Aug. 1873.

tate simplicium, cap. i. (Agrostis).
licamentis, cap. xxvi.

[5] Tetrabibli primæ, sermo i.

[6] As in the *Herbarius Patavie* printed in 1485, in which it is said of *Gramen*: "aqua decoctionis ejus . . . valet contra dissuriam . . . et frangit lapidem et curat vulnera vesicæ et provocat urinam . . . ."

[7] Herball, part 2, 1568, 13.

rhizome, $\frac{1}{10}$ of an inch in diameter, creeping close under the su the ground, occasionally branching, marked at intervals of about by nodes, which bear slender branching roots and the remains of ing rudimentary leaves.

As found in the shops, the rhizome is always free from root into short lengths of $\frac{1}{8}$ to $\frac{1}{4}$ of an inch, and dried. It is thus in t of little, shining, straw-coloured, many-edged, tubular pieces, w without odour, but have a slightly sweet taste.

Microscopic Structure—A transverse section of this rhizom two different portions of tissue, separated by the so-called nucleus The latter consists of an unbroken ring of prismatic cells, anal those occurring in sarsaparilla. In *Rhizoma Graminis*, the outer the tissue exhibits a diffuse circle of about 20 liber bundles, interior part about the same number of fibro-vascular bundl densely packed. The pith is reduced to a few rows of cells, the being always hollow, except at the nodes. No solid contents a met with in the tissue.

Chemical Composition—The constituents of couch-grass no substance to which medicinal powers can be ascribed. T of the rhizome afforded to H. Müller[1] about 3 per cent. of suga to 8 per cent. of *Triticin*, $C^{12}H^{22}O^{11}$, a tasteless, amorphous, gum stance, easily transformed into sugar if its concentrated solution for a short time at 110° C. When treated with nitric acid, i oxalic acid. The rhizome affords also another gummy matter co nitrogen, and quickly undergoing decomposition; the drug mor somewhat rich in acid malates. Mannite is probably occasiona sent as in taraxacum (p. 353), for such is the inference we dra the opposite results obtained by Stenhouse and by Völcker. pectin and resin are wanting. The rhizome leaves $4\frac{1}{2}$ per cent. o

Uses—A decoction of the rhizome has of late been recomme mucous discharge from the bladder.

Substitutes—*Agropyrum acutum* R. et S., *A. pungens* R. et *A. junceum* P. Beauv., by some botanists regarded as mere m varieties of *A. repens*, have rootstocks perfectly similar to this latt

Cynodon Dactylon Pers., a grass very common in the South of and Northern Africa, affords the *Gros Chiendent* or *Chiendent pied-d* of the French. It is a rhizome differing from that of couch-g being a little stouter. Under the microscope, it displays an e different structure, inasmuch as it contains a large number of stronger fibro-vascular bundles, and a cellular tissue loaded with and is therefore in appearance much more woody. It thus approx to the rhizome of *Carex arenaria* L., which is as much used in Ge as that of *Cynodon* in Southern Europe. The latter appears to c *Asparagin* (the *Cynodin* of Semmola[2]), or a substance similar to i

[1] *Archiv der Pharm.* 203. (1873) 17.

[2] Della *Cinodina*, nuovo prodotto organico, trovato nella gramigna officinale, *Cynodon Dactylon.—Opere minori di Giovanni Semmola*, Napoli, 1841. — Abstracted *Jahresbericht* of Berzelius, Tubinge 535.

Acrogens.

LYCOPODIACEÆ.

LYCOPODIUM.

Semen vel Sporulæ Lycopodii; Lycopodium; F. *Lycopode;* G. *Bärlappsamen, Hexenmehl.*

Botanical Origin—*Lycopodium clavatum* L.—This plant, the Com- Clubmoss, is almost cosmopolitan. It is found on hilly pastures and ıs throughout Central and Northern Europe from the Alps and nees to the Arctic regions, in the mountains of the east and centre pain, throughout Russian Asia to Amurland and Japan, in North South America, the Falkland Isles, Australia and the Cape of Good a. It occurs throughout Great Britain, but is most plentiful on the s of the northern counties.

he part of the plant employed in pharmacy, is the minute spores, h, as a yellow powder, are shaken out of the kidney-shaped capsules ›orangia, growing on the inner side of the bracts covering the spike.

History—The Common Clubmoss was well known as *Muscus ter-* s or *Muscus clavatus*, to the older botanists, as Tragus, Dodonæus, :æmontanus, Bauhin, Parkinson and Ray, by most of whom its ›sed virtues as a herb have been commemorated. Though the er (spores) was officinal in Germany, and used as an application to ds in the middle of the 17th century,[1] it does not appear to have known in the English shops until a comparatively recent period. ıot included by Dale [2] in the list of drugs sold by London druggists)2, nor enumerated in English drug lists of the last century; and er had a place in the London Pharmacopœia.

escription—Lycopodium is a fine, mobile, inodorous, tasteless :r of pale yellow hue, having at 16° C., a sp. gr. of 1·062. It floats ;ter and is wetted with difficulty, yet sinks in that fluid after

[1] ıöder, *Pharmacopœia Medico-chymica,* ugd. 1656. 538.

[2] *Pharmacologia,* Lond. 1693.

marked by minute ridges, forming by their intersections, r
six-sided meshes. At the points of intersection, small
produced, which under a low magnifying power, give tl
speckled appearance. Below this network, lies a yellow, c
but compact membrane, which exhibits considerable power
not being ruptured either by boiling water or by potash
vitriol does not act upon it in the cold, even after severa
instantly penetrates the grains and renders them transpa
the same time numerous drops of oil make their appearanc
exude.

Chemical Composition—One of the most remarkabl
of lycopodium spores is a fixed oil, which they contain to tl
amount of 47 per cent. Bucholz pointed out its existence
obtained it only to the extent of 6 per cent. Yet if t
thoroughly comminuted by prolonged trituration with s
then exhausted with chloroform or ether, we find that the
tion above mentioned can be obtained. The oil is a bland
does not solidify even at – 15° C.

By subjecting lycopodium or its extract to distilla
without an alkali, Stenhouse obtained volatile bases, the
which we can fully confirm; but they occur in exceedingl
portion. The ash of lycopodium amounts to 4 per cent.; it is
it contains alumina, and one per cent. of phosphoric acid,
likewise found in the green parts of the plant.

Production and Commerce—To obtain lycopodium
the plant are cut as the spikes approach maturity, taken h
powder shaken out and separated by a sieve. It is collec

ılteration—The spores are so peculiar in structure, that they distinguished with certainty by the microscope from all other ces. It is only the species of clubmoss that are nearly related *aratum*,[1] that yield an analogous product, and this may be used ual advantage.

ch and dextrin, which are sometimes fraudulently mixed with ıres, are easily recognized by the well-known tests. Inorganic ures, as gypsum or magnesia, may be detected by their sinking in ide of carbon, whereas lycopodium rises to the surface; or by ıtion, a good commercial drug leaving about 4 per cent. of ash. llen of phænogamous plants, as of *Pinus silvestris*, looks at first uch like lycopodium, but its structure is totally different.

FILICES.

RHIZOMA FILICIS.

Filicis maris; Male Fern Rhizome, Male Fern Root; F. *Racine de Fougère mâle;* G. *Farnwurzel.*

tanical Origin—*Aspidium Filix-mas* Swartz (*Polypodium* L.) ıle fern is one of the most widely distributed species. It occurs Europe from Sicily to Iceland, in Greenland, throughout Central ıssian Asia to the Himalaya and Japan; is found throughout and again in Java and the Sandwich Islands. In North America anting in the Eastern United States, being principally replaced nearly allied *Aspidium marginale* Sw. and *A. Goldieanum* Hook.; is met with in Canada, California and Mexico, as well as in New a, Venezuela, Brazil, and Peru; and throughout Africa from to the Cape Colony and Mauritius.

ıtory—The use of the rhizome of ferns as a vermifuge, was to the ancients,[2] but was subsequently nearly forgotten until by the introduction of certain secret remedies for tapeworm, of powdered male fern rhizome, combined with drastic purgatives, hief constituent.

nedicine of this kind was prepared by Daniel Mathieu, a native châtel, born in 1741, who established himself as an apothecary in His treatment for the parasite was so successful that it attracted ice of Frederick the Great, who purchased his nostrum for an of 200 *thalers* (£30), besides conferring upon him the dignity of Councillor.[3]

at celebrity was also gained for the method of treating tapeworm d by Madame Nuffler or Nuffer, the widow of a surgeon at Murten in Switzerland, who in 1775 obtained for the secret from Louis ıfter an inquiry by *savans* of the period, the sum of 18,000 livres. thod of treatment consisted in the administration of—1. Panada f bread with a little butter. 2. A clyster of salt water and olive The "*spécifique*"—simply *powdered fern-root*. 4. A purgative

cially *L. annotinum*, *L. complanatum*, and *L. inundatum*.

ay, *Apparatus Medicaminum*, v. 3–471.

[3] Cornaz, *Les familles médicales de la ville de Neuchâtel*, 1864. 20.

bolus of calomel, gamboge, scammony, and *Confectio hyacinthidi* in the foregoing order.[1]

Peschier[2] of Geneva recommended as a substitute for t powder of the root, an ethereal extract, an efficient preparati though proposed in 1825, was scarcely used in England u 1851; at present it is the only form in which male fern is emp

Description—The fresh rhizome or caudex is short and ma inches in diameter, decumbent, or rising a few inches above th and bearing on its summit a circular tuft of fronds, which in t part are thickly beset with brown chaffy scales. Below the grow are the remains of those of previous seasons, which retain in fleshy bases, vitality and succulence for years after their upp has perished. From among these fleshy bases, spring the bl branching roots. The rhizome is rather fleshy, and easily c knife, internally of a bright pale yellowish green; it has very li and a sweetish astringent taste. For pharmaceutical use, it collected in the late autumn, winter or early spring, divested o portions, split open, dried with a gentle heat, reduced to coar and at once exhausted with ether. Extract obtained in thi more efficient than that which has been got from rhizome that kept some time.

Microscopic Structure—On transverse section of the the tissue, shows rounded, somewhat polyhedral cells with poro the outer cells are brown and rather smaller, but do not e regular flattened shape, usual in many suberous coats. Wi cortical layer, there is a circle of about 10 large vascular besides a large number of smaller ones scattered beyond t The leaf-bases exhibit a somewhat different structure, their bundles, usually 8, forming but one diffuse circle.

The cells of the parenchyme contain starch, greenish or granules of tannic matter, and drops of oil. In the green, v vegetating parts of the rootstock there are numerous smaller a intercellular spaces, into which a few stalked glands project, a by Prof. Schacht of Bonn in 1863. These globular glands from the cells bordering the intercellular spaces. After their c development, and the appearance of starch in the adjacent pare they exude a greenish fluid, which when thin slices of the rhiz kept some time in glycerin, solidifies in acicular crystals.[3] glands appear to be wanting in most of the allied ferns, *Aspidium Oreopteris* Sw. and *Asplenium Filix-fœmina* Bernh. have been observed by one of us (F.), in the rhizome of *A. spinulo* Similar glands but not exuding a green liquid, occur between th below the vegetating cone of the rootstock.

Chemical Composition—Of the numerous examinations have been made of this drug, those of Bock (1852), and of Luck

[1] *Traitement contre le Ténia ou ver solitaire, pratiqué à Morat en Suisse, examiné et éprouvé à Paris.* Publié par ordre du Roi, 1775. 4°, pp. 30. 3 plates, one representing the plant, its rhizome and leaves.—Also English translation by Dr. Simmons, London, 1778. 8°.

[2] *Bibliothèque Universelle*, xxx. xxx. (1826) 326.

[3] The chemical nature of this mains to be ascertained. The probably *Filicic Acid*, accomp chlorophyll and essential oil.

ı especially mentioned. Besides the universally distributed con-
ts of plants, there have been found in the rhizome 5 to 6 per
f a green fatty oil, traces of volatile oil, resin, tannin (Luck's
spidic and *Pteritannic Acids*) and crystallizable sugar, which
ng to Bock, is probably cane sugar.

ı medicinal ethereal extract, of which the rhizome yields about
ent., deposits a colourless, granular, crystalline substance, noticed
chier as early as 1826, and subsequently designated by Luck,
Acid. Grabowski (1867) assigned it the formula, $C^{14}H^{18}O^{5}$.
rn from Prof. Buchheim that he regards filicic acid as the source
medicinal efficacy of the drug. By fusion with potash, filicic acid
erted into phloroglucin and butyric acid. The green liquid por-
the extract consists mainly of a glyceride called *Filixolin*, from
Luck obtained by saponification two acids, the one volatile, *Filos-*
Acid, the other non-volatile, termed *Filixolic Acid.*

lin (1867) showed that the tannic acid of male fern may be
posed by boiling dilute acids, into sugar and a red substance,
ed, $C^{26}H^{18}O^{12}$, analagous to Cinchona-red.

ıoonbroodt[1] performed some interesting experiments with *fresh*
ot, showing that it contains *volatile acids* of the fatty series,
which is probably *formic;* but also a fixed acid, accompanied by
of disagreeable odour. The liquid distilled from the dried root
ot evolve a similar odour, nor did it contain any acid body.
ll quantity of essential oil was obtained by means of ether
he alcoholic extract of the fresh but not of the dried root-

e substance called *Aspidine*, regarded by Pavesi as the active con-
t, seems to be essentially filicic acid. The rhizome of male fern
2 to 3 per cent. of ash, consisting mainly of phosphates, carbonates,
lphates of calcium and potassium, together with silica.

es—The ethereal extract has been prescribed for all kinds of
nal worms; but recent experience goes to prove that its effects
efly exhibited in cases of tapeworm. It is equally and thoroughly
ous in the three kinds respectively termed *Tænia solium*, *T.*
cannellata and *Bothriocephalus latus.*

bstitution—The rhizomes of *Asplenium Filix-fœmina* Bernh.,
um Oreopteris Sw., and *A. spinulosum* Sw. may be mistaken for
f *A. Filix-mas.* The best means of distinguishing them is
d by transverse sections of the leaf-bases. In *Filix-mas*,
tion exhibits 8 vascular bundles,—in the other ferns named, only
lifference easily ascertained by examination under a lens.

rnal de Médecine de Bruxelles, 1867 and 1868—also Wittstein's *Vierteljahres-*
ür prakt. Pharm. xviii. (1869) 106.

Thallogens.

LICHENES.

LICHEN ISLANDICUS.

F. *Lichen ou Mousse d'Islande*; G. *Isländisches* [illegible]

[illegible] gin—[illegible] *slandica* Acharius.[1]—It is [illegible] [illegible] ern [illegible] G[illegible] nland, Spitzbergen, Siberia, [illegible] [illegible] e it gr[illegible] s even in the plains. It is [illegible] the mou[illegible] of G[illegible] Britain, France, Italy and [illegible] [illegible] and and in [illegible] southern [illegible] nubian countries. It also [illegible] No[illegible] A[illegible] ca and in the Antarctic regions.

H[illegible] ory—In the North of Europe, this lichen has long been under the general name of *Mosi*, *Mossa* or *Mus* as an article of Ole Borrich, of Copenhagen (1671), called it *Muscus catharticus*, und[illegible] notion that in early spring it possesses purgative properties.[2] medicinal employment in pulmonary disorders was favourably spo[illegible] by Hjärne in 1683,[3] but it is only since 1757 that it has come general use as a medicine, chiefly on the recommendation of Lin[illegible] and Scopoli.

Description—The plant consists of an erect, foliaceous, bran[illegible] thallus, about 4 inches high, curled, channelled or rolled into [illegible] terminating in spreading truncate, flattened lobes, the edges of [illegible] are fringed with short thick prominences. The thallus is smooth, or of a light olive-brown; the under surface is paler and irreg[illegible] beset with depressed white spots. The apothecia (fruits), which a[illegible] very common, appear at the apices of the thallus, as rounded bo[illegible] bodies, $\frac{2}{10}$ to $\frac{3}{10}$ of an inch across, of a dark, rusty colour. The [illegible] and mode of division of the thallus vary greatly, so that many va[illegible] of the plant have been distinguished.

In the dry state, Iceland moss is light, harsh and springy; it a[illegible] water in which it is placed, to the extent of a third of its w[illegible] becoming soft and cartilaginous; it ordinarily contains about 1[illegible] cent. of hygroscopic water. It is inodorous, but when wetted slight seaweed-like smell; its taste is slightly bitter.

[1] *Cetraria* from *cetra*, an ancient shield of hide, in allusion to the circular apothecia.

[2] Bergius, *Materia Medica*, Stockholm, ii. (1778) 856.

[3] Murray, *Apparatus Medicami*[illegible] (1790) 510.

croscopic Structure—A transverse section exhibits when y magnified, a broad loose central layer of long, thick-walled ing cells or *hyphæ*, containing air, and enclosing wide hollow This middle layer encloses a certain number of larger cells *onidia*, coloured with chlorophyll. The gonidia are not destroyed by strong sulphuric acid, or by boiling them with potash. They however a deep violet colour when treated with caustic potash n left for 24 hours in a solution of iodine in potassium iodide.

tissue on either side of this central layer consists of very felted hyphæ, without intervening spaces, and does not appear tain any particular substance. This compact and tenacious passes into a thin cortical layer consisting of cells very closely together. Under the influence of reagents this layer becomes ident: thus when moistened with strong sulphuric or hydrochloric separates from the rest of the tissue as a coherent membrane, ls itself backward. On boiling with water the inner tissue swells cell-walls being partly dissolved. Thin slices of the lichen are d reddish or pale blue by iodine water,—more distinctly blue, if isly treated with sulphuric acid. The colour spreads uniformly e inner tissue, but no starch granules can be detected; the cortical s merely coloured brown by iodine. The white spots on the outer of the thallus are resolved by pressure under a plate of glass inute round transparent granules, not coloured by iodine, and branched cells like those of the central layer.

e short, thick prominences on the edge of the thallus, frequently ate in one or more sac-like cavities (*spermogonia*) containing a umber of simple bar-shaped cells (*spermatia*), only 6 mkm. long; re enveloped in transparent mucus, and may be expelled by re under glass. It has been shown by Stahl (1874) that they repre- e fertilizing corpuscles of seaweeds of the class *Florideæ*.

e observations of De Bary (1866) and Schwendener (1867–70) ned and much extended by the researches of Bornet[1] (1873–74), shown that the gonidia of lichens are referable to some of *Alga*, and are capable of an independent existence; that the ns of the hyphæ to the gonidia are of such a nature as to exclude sibility of either of those bodies being produced by the other; rther, that the theory of parasitism is the only one capable of ning these relations in a satisfactory manner. Under this singular , lichens are compound organisms, formed of an alga, and of a living upon it as a parasite.

emical Composition—Boiling water extracts from Iceland as much as 70 per cent. of the so-called *Lichenin* or *Lichen-starch*, which is perfectly devoid of structure. The decoction (1 : 20) izes on cooling, and assumes a reddish or bluish tint by solution ine. This property of lichenin is plainly seen, when the drug is hausted by boiling spirit of wine containing some carbonate of ium; and then boiled with 50 to 100 parts of water, and the decoc- recipitated by means of alcohol. The lichenin thus obtained in a state, must be deprived of alcohol by cautiously washing it with

[1] *Recherches sur les gonidies des Lichens.—Ann. des Sciences nat.* (Bot.) xvii. (1873) 11 plates; also xix. (1874) 314–320.

water. Powdered iodine will now immediately impart to it whi moist an *intense blue*. Its composition, $C^{10}H^{20}O^{10}$, agrees with starch and cellulose; and it must be regarded as a modification latter, being likewise soluble in water and in ammoniacal solu copper. Lichenin is not a kind of mucilage, because it yiel insignificant traces of mucic acid, if treated with concentrated acid; and also because it contains no inorganic constituents.[1] T trifling proportion of mucic acid it furnishes, may depend up presence, in small amount, of an independent mucilaginous body.

The chlorophyll of the gonidia is not soluble in hydrochlor and hence is distinguished by Knop and Schnedermann as *Thall* its quantity is extremely small.

The bitter principle of cetraria, called *Cetraric Acid* or C $C^{18}H^{16}O^{8}$, crystallizes in microscopic needles, is nearly insoluble water, and forms with alkalis, yellow, easily soluble, bitter salts lichen also contains a little sugar, and about 1 per cent. of a p body, *Licheno-stearic Acid*, $C^{14}H^{34}O^{3}$, the crystals of which m 120° C. The *Lichenic Acid* found by Pfaff in 1826 in Iceland mo formerly regarded as a peculiar compound, has been proved id with fumaric acid.

In common with many lichens, cetraria contains *Oxalic Acid* said to yield also some tartaric acid. The ash which amounts per cent., consists to the extent of two-fifths, of silicic acid co chiefly with potash and lime.

Collection and Commerce—Iceland moss is collected in districts where the plant abounds, at least for local use, as in S whence some is shipped to other countries. It is also gathe Switzerland, especially on the mountains of the canton of Lucern in Spain.[2] None is exported from Iceland.

Uses—It is given in decoction as a mild tonic, combined with active medicines. It is very little employed in Iceland, and o seasons of scarcity, when it is sometimes ground and mixed wi flour used in making the *grout* or grain soup. Occasionally it is boiled in milk. It is not given, as has been asserted, to do animals.

An interesting application of Iceland moss has recently been in Sweden. Sten-Stenberg treats it with sulphuric or hydrochloric when 72 per cent. of grape sugar are formed, which may be verted into alcohol.[3]

FUNGI.

SECALE CORNUTUM.

Ergota[4]; *Ergot of Rye, Spurred Rye*; F. *Seigle ergoté*; G. *Mutterk*

Botanical Origin—*Claviceps purpurea* Tulasne, a fungus of order *Pyrenomycetes*, of which ergot is an immature form, it being

[1] The various mucilages and gums yield from 4 to 20 per cent. of ash, but pure ichenin yields *none*.

[2] *Cat. of Spanish Productions*,—London Exhibition, 1851.

[3] Dingler's *Polytechnisches Journal* (1870) 177; also *Chemisches Centra* 1870. 607.

[4] From the French *ergot*, anciently a cock's spur.

(termed in the British Pharmacopœia *compact mycelium* or *spawn*)
l within the paleæ of numerous plants of the order *Gramineæ*.
is obtained almost exclusively from rye, *Secale cereale* L.; but
fungus is produced on grasses belonging to many other genera,
rum, Alopecurus, Ammophila, Anthoxanthum, Arrhenatherum,
achypodium, Calamagrostis, Dactylis, Glyceria, Hordeum, Lolium,
Triticum. Other organisms of diverse form, but of doubtful
istinctness, are developed in *Molinia, Oryza, Phragmites*, and
sses. In the order *Cyperaceæ* (e.g. *Scirpus*), peculiar ergots
1.

ory—Although it is hardly possible that so singular a production
hould be unnoticed in the writings of the classical authors, we
undoubted reference to it has been discovered.[1] The earliest
er which we find ergot mentioned on account of its obstetric
towards the middle of the 16th century, by Adam Lonicer of
, who describes its appearance in the ears of rye, and adds that
ded by women to be of remarkable and certain efficacy.[2] It
ry clearly described in the writings of Johannes Thalius (1588),
ks of it as used, "*ad sistendum sanguinem.*"[3] In the next
t was noticed by Caspar Bauhin (1623), who termed it *Secale*
;[4] and in 1693, by the English botanist Ray, with allusion to
inal properties.[5]

aw, a Dutch accoucheur, employed ergot in 1747. Thirty years
sgranges of Lyons prescribed it with success; but its peculiar
rtant properties were hardly allowed until the commencement
esent century, when Dr. Stearns of New York succeeded in
'or them fuller recognition.[6] Ergot of rye was not however
into the London Pharmacopœia until 1836.[7]

se of flour containing a considerable proportion of ergot, gives
very formidable disease, distinguished in modern medicine as
but known in early times by a variety of names, as *Morbus*
us, convulsivus, malignus, epidemicus vel cerealis, Raphania,
raphania[8] or *Ignis sancti Antonii.*

of the malignant epidemics which visited Europe after seasons
nd scarcity during the middle ages, have been referred with
less of probability to ergot-disease.[9] The chroniclers of the
8th centuries note the occurrence of maladies which may be
as due to ergotized grain. There is less of doubt regarding
mics that prevailed from the 10th century and were frequent in
nd in the 12th in Spain. In the year 1596, Hesse and the
regions were ravaged by a frightful pestilence, which the
Faculty of Marburg attributed to the presence of ergot in the
onsumed by the population. The same disease appeared in

Pliny's *Nat. Hist.* book 18. ch. 44.
buch, ed. 1582. 285 (not in the
560).
'ercynia, Francof. 1588. 47.
Theatri Botanici, Basil. 1623. 23.
lant. ii. (1693) 1241.
Therapeutics and Mat. Med. ii.

825 to 1828, the wholesale price
rye in London was from 36s. to
50s. per lb., that is to say, from twelve to
fifteen times its present value.

[8] Pereira, *Elem. of Mat. Med.* ii. (1850)
1007.

[9] Consult Häser, *Lehrbuch der Geschichte der Medicin und der Volkskrankheiten*, 1845.
i. 256. 830, ii. 94; C. F. Heusinger, *Recherches de Pathologie comparée*, Cassel, i.
(1853) 543-554; Mérat et De Lens, *Dict.*
Mat. Med. iii. 131, vii. 268.

France in 1630, in Voigtlandia (Saxony) in the years 1648, 1649 and 1675; again in various parts of France, as Aquitaine and Sologne, in 1650, 1670 and 1674. Freiburg and the neighbouring region were visited by the same malady in 1702; other parts of Switzerland in 1715–16; Saxony and Lusatia in 1716; many other districts of Germany in 1717, 1722, 1736 and 1741–2.[1] The last epidemic in Europe occasioned by ergot, appears to be that which, after the rainy season of 1816, visited Lorraine and Burgundy, and proved fatal to many people of the poorer class. Ergot disease is sometimes observed in Abyssinia at the present day,[2] and a few cases of it have even been lately recorded in Bavaria.[3]

Formation—The true nature of ergot has long been the source of a great diversity of opinion, now set at rest by the admirable researches of L. R. Tulasne, from whose *Mémoire sur l'Ergot des Glumacées*,[4] the following account is for the most part extracted.

The formation of ergot often affects only a few caryopsides in a single ear; sometimes however, more than twenty. In the former case, the healthy development of the other caryopsides is not prevented, but if too many are attacked, the entire ear decays. The more isolated ergots generally grow larger, and attain their greatest size on rye which springs up here and there among other cereals.

The first symptom of ergot-formation is the so-called *honey-dew of rye*, a yellowish mucus, having an intensely sweet taste, and the peculiar disagreeable odour frequently belonging to fungi. Drops of this mucus show themselves here and there on the ears in the neighbourhood of diseased grains, and attract ants and beetles of various kinds, especially the yellowish-red *Rhagonycha melanura* Fabr., but not bees. On this account, the beetle in question has been supposed to be instrumental in the development of ergot, and it may possibly be so, but only by transporting the saccharine mucus from one plant to another.

The honey-dew of rye contains neither oil-drops nor starch. After dilution with water, it produces a rapid and abundant separation of cuprous oxide from an alkaline solution of cupric tartrate. Dried over sulphuric acid, it solidifies into a crystalline mass. After a few days, the drops of honey-dew dry up and disappear from the ear. The grain at this period becomes completely disintegrated, and devoid of starch.

The ergotised soft ovaries are covered with, and penetrated by a white, spongy, felted tissue, the *mycelium* of the young fungus. It is made up of slender, threadlike cells, the *hyphæ*, the outer layer of which consists of radially-diverging cells, the *basidia*. The whole mycelium forms by its crevices and folds, a number of cavities opening externally; from its outer layer, which is also called the *hymenium* or *spermatophorum*, an immense number of agglutinated, elongated granules, the *conidia*, are separated. These cells, the products of the basidia, are not more than 4 mkm. in length, and give the floral organs the appearance of being covered with a whitish dust. The honey-dew likewise contains an abundance of conidia, but it is only on dilution that they are precipitated and become easily perceptible; the formation of the honey-dew is

[1] Tissot of Lausanne, *Phil. Trans.* lv. (1766) 106.—See also *Hist. de la Soc. roy. de Méd.*, année 1776. 345; and *Mém. de Méd. et de Phys. méd.* année 1776. 260–311. 417.

[2] Th. von Heuglin, *Reise nach Abessinien*, &c. Jena, 1868. 180.

[3] Wiggers and Husemann, *Jahresbericht* for 1870. 582.

[4] *Ann. des Sciences nat.*, Bot., II. (1853) 1–56 and 4 plates.

intimately connected with that of the conidia themselves. Ergot in this primary or mycelium stage was regarded as an independent fungus by Leveillé (1827), who named it *Sphacelia segetum*. According to Kühn (1863), it may even be directly reproduced by germination of the conidia within the ears of rye.

The mycelium penetrates and envelops the caryopsis, with the exception of the apex, and thereby prevents its further growth, destroying especially the epicarp and the embryo. At the base of the caryopsis, there is formed by tumefaction and gradual transverse separation of the thread-cells of the mycelium, a more compact kernel-like body (the future ergot) violet black without, white within, which gradually but largely increases in size, and ultimately separates from the mycelium as the loose tissue of the latter dries and shrinks up after the completion of its functions. By this growth, the remains of the caryopsis, still recognizable by their hairs and by the rudiments of the style, as well as by the surviving portions of the mycelium-tissue, become visible above the paleæ on the apex of the mature ergot, now projecting prominently from the ear. Very rarely the ergot is crowned by a fully developed seed; in the commercial drug, the apex is usually broken off.

It is evident that in the process of development just described, the very tissue of the caryopsis of the rye does not undergo a *transformation*, but that it is *simply destroyed*. Neither in external form, nor in anatomical structure does ergot exhibit any resemblance to a caryopsis or a seed, although its development takes place between the flowering time and that at which the rye begins to ripen. It has been regarded as a complete fungus, and as such was named by De Candolle (1816) *Sclerotium Clavus* and by Fries *Spermoedia Clavus*.

No further change in the ergot occurs while it remains in the ear, but laid on damp earth, interesting phenomena take place. At certain points, small orbicular patches of the rind, fold themselves back and gradually throw out little white heads. These increase in size whilst the outer layers of the neighbouring tissue gradually lose their firmness and become soft and rather granular at the same time that the cells of which they are made up, become empty and extended. In the interior of the ergot, the cells retain their oil drops unaltered. The heads assume a greyish-yellow colour changing to purple, and finally after some weeks stretch themselves towards the light on slender shining stalks of a pale violet colour. The stalks often attain an inch in length, with a thickness of about ½ a line. They consist of thin, parallel closely felted cell-threads, devoid of fat oil. Ergot is susceptible of this further development only so long as it is fresh, that is to say, at most until the next flowering time of rye. Within this period however, even fragments are capable of development. There are sometimes also produced colourless threads of mould which belong to other fungi, as *Verticillium cylindrospermum* Corda, and which frequently overgrow the *Claviceps*.[1]

[1] Ergot of rye collected by myself in August, placed upon earth in a garden pot and left in the open air unprotected through the winter, began to develop the Claviceps on the 20th March, and on another occasion on the 20th April, at which date some sowed in February also began to start. Sharp frost appears to retard the vegetation; thus, after the cold winter of 1866-7, [illegible] even in the greenhouse, [illegible] appearance before the 11th May. The earliest instance of fully developed ergot which I ever observed occurred on the 11th of June; more frequently they are seen only in the beginning of July.—F. A. F.

At the point where the stalk joins the spherical or somewhat flattened head, the latter is depressed and surrounds the stalk with an annular border. After a short time there appear on the surface of the head, which is $\frac{1}{10}$ of an inch in diameter, a number of brownish warts, in which are the openings of minute cavities, the *conceptacula* or *perithecia*. On transverse section, they appear arranged radially round the circumference of the head. In each cavity are a large number of delicate sacs, only 3–5 mkm. thick, and about 100 mkm. long, the *thecæ* or *asci*, each containing, as is usual in fungi, 8 spores. These are simple thread-shaped cells, filled with a homogeneous solid mass.

The thicker ends of the spore-sacs (*asci*) open while still within the perithecium; the spores issue united in a bundle, and are emitted from the aperture of the perithecium. In consequence of their somewhat glutinous consistence, they remain united even after their extrusion, and form white silky flocks; their number in the 20 or 30 heads sometimes produced from a single ergot, often exceeds a million. The heads themselves die in two or three weeks after they have begun to make their appearance. They represent the true fructification of the fungus. This state of the plant appears to have been first noticed in 1801 by Schumacher, who called it *Sphæria;* it was subsequently known as *Cordiceps, Cordyliceps, Kentrosporium*, &c., until Tulasne proved it to be the final stage of development of ergot.

The three different forms of this structure, namely, the mycelium, the ergot, and the fruit-bearing heads, are therefore merely successive states of one and the same biennial fungus, which have been appropriately united by Tulasne under the name of *Claviceps purpurea*. The middle stage forms the *sclerotium*, which occurs in a large number of the most various fungi, and is a special state of rest of these plants. The direct proof that the mycelium is produced from spores of the fruit-head sown on ears of rye, was supplied by Kühn in 1863. It has already been mentioned that the same organism is produced from conidia; whence it appears that a twofold formation of ergot is possible, as is frequently the case in other fungi.

Description—Spurred rye, as found in commerce, consists of fusiform grains, which it is convenient to term *ergots*. They are from $\frac{1}{3}$ to $1\frac{1}{2}$ inch in length, and $\frac{1}{2}$ to 4 lines in diameter; their form is subcylindrical or obtusely prismatic, tapering towards the ends, generally arched, with a longitudinal furrow on each side. At the apex of each ergot, there is often a small whitish easily detached appendage, while the opposite extremity is somewhat rounded. The ergots are firm, horny, somewhat elastic, have a close fracture, are brittle when dry, yet difficult to pulverize. The whitish interior is frequently laid bare by deep transverse cracks. The tissue is but imperfectly penetrated by water, even the thinnest sections swelling but slightly in that fluid.

Ergot of rye has a peculiar offensive odour, and a mawkish, rancid taste. It is apt to become deteriorated by keeping, especially when pulverized, partly from oxidation of the oil, and partly from the attacks of a mite of the genus *Trombidium*. To assist its preservation, it should be thoroughly dried, and kept in closed bottles.

Microscopic Structure—In fully developed ergot, no organs can be distinguished. It consists of uniform, densely felted tissue of short,

thread like, somewhat thick-walled cells, which are irregularly packed and so intimately matted together that it is only by prolonged boiling of thin slices with potash, and alternate treatment with acids and ether, that the individual cells can be made evident. Without such treatment, the cells even in the thinnest sections show a somewhat rounded, nearly isodiametric outline. This pseudo-parenchyme of ergot exhibits therefore an aspect somewhat different from that of the loosely felted cells (*hyphæ*) of other fungi. Ergot nevertheless is not made up of cells differing from those of fungi generally. If thin longitudinal slices of the innermost tissue are allowed to remain in a solution of chromic acid containing about 1 per cent., they will distinctly show the *hyphæ*, which are however considerably shorter than those of other fungi. They contain numerous drops of fat oil, but neither starch nor crystals. It is remarkable that this nearly empty and not much thickened parenchyme should form so compact and solid a tissue.

The cell-walls of the tissue of ergot are not coloured blue, even after prolonged treatment with iodine in solution of potassium iodide; or when the tissue has been previously treated with sulphuric acid, or kept for days in contact with potash and absolute alcohol at 100° C. In this respect the cellulose of fungi differs from that of phanerogamic plants.

Of the outermost rows of cells in ergot, a few only are of a violet colour, but they are not otherwise distinguishable from the colourless tissue,—or at most by the somewhat greater thickness of their walls.

Chemical Composition—The composition of ergot has been several times investigated, and elaborately by Wiggers as early as 1830. The drug contains about 30 per cent of a fatty, non-drying, yellowish, saponifiable oil, chiefly consisting of olein, palmitin, and small proportions of volatile fatty acids, especially acetic and butyric, combined with glycerin. The oil is accompanied by small quantities of [illegible] and *cholesterin*. It is erroneous to attribute to this oil the poisonous properties of ergot, although it has been shown by Ganser,[1] to display irritating properties when taken in doses of about 6 grammes. But the effects observed appear dependent on the presence in it of resin (7 per cent.).

According to Wenzell (1864), ergot of rye contains two peculiar alkaloids, which he designated *Ecboline* and *Ergotine*. They are soluble in water, and have an alkaline reaction and a bitterish taste. They were not got in a state of purity, but merely as brownish substances forming deliquescent compounds with acids,—in either case, amorphous. Ganser however, claims to have obtained long acicular crystals of the hydrochlorate of ergotine. Ecboline possesses in a high degree the special medicinal properties of ergot of rye; ergotine, which is less bitter, is but little active. Manassewitz (1867) obtained 0·12 per cent. of ergotine; Ganser, 0·04 of the same alkaloid, and 0·16 of ecboline. The two bodies may be easily separated by mercuric chloride, which yields an insoluble compound with ecboline only. Manassewitz assigned to ergotine the formula $C_{10}H_{18}N_2O_3$, which requires confirmation.

The two bases of ergot were found by Wenzell, to be combined with

[1] [illegible]

[2] The name *Ergotin* has [illegible] to a medicinal extract of ergot, prepared [illegible] after a method devised by Bonjean, a phar-

Ergotic Acid, the existence of which has been further proved by Ganser. It is a volatile body yielding crystallizable salts.

Ergot in common with other fungi,[1] contains a sugar termed *Mycose*, closely allied to cane sugar, and still more so to *Trehalose*, from which it differs only in having a rather less dextrogyre power. Mycose crystallizes in rhombic octohedra, having the composition $C^{12}H^{22}O^{11} + 2H^2O$. Mitscherlich obtained of it about one-tenth per cent. It appears that the sugar exuded in the first stage of growth of the fungus,—the so-called *rye honey-dew*,—is in its principal characters different from mycose. Instead of the latter, Mitscherlich as well as Fiedler and Ludwig, sometimes obtained from ergot, *Mannite*.

The *red colouring matter* of ergot is soluble neither in benzol, alcohol, nor ether, but is easily extractable by alcohol or water mixed with a little ammonia, or by a mineral acid (not acetic). From its neutralized alcoholic solution, it may be precipitated by acetate of lead. It appears to contain iron and nitrogen (Winckler, Manassewitz). Spectroscopically examined, we find its solution to extinguish the blue and the green ray.

Schoonbroodt in 1866, as well as Ludwig in 1869, pointed out the presence in ergot of *Cholesterin*, a crystallizable principle widely distributed in the animal kingdom, and which has been detected in other fungi. It may be isolated by shaking the fat oil of ergot with warm alcohol. Ganser thus obtained 0·036 parts of chloresterin from 100 of the drug. Schoonbroodt also found in ergot, *Lactic Acid*. Several other chemists have further proved the presence of acetic and formic acids.

Starch is entirely wanting in ergot at all times. The drug yields about 3 per cent. of nitrogen, corresponding probably to a large amount of albuminoid matter. Ganser however obtained only 3·2 per cent of albumin *soluble in water*.

When ergot or its alcoholic extract is treated with an alkali, it yields as products of the decomposition of the albuminoid matters, ammonia or ammonia-bases,—according to Ludwig and Stahl, *Methylamine*,—according to others, *Trimethylamine*. Manassewitz, as well as Wenzell, state that phosphate of trimethylamine is present in an aqueous extract of ergot, but Ganser ascertained that no such base *pre-exists* in ergot. We have found that the crystals which abound in the extract after it has been kept for some time, are an acid phosphate of sodium and ammonium with a small proportion of sulphate.[2]

Production and Commerce—Ergot of rye is chiefly imported into London from Vigo in Spain and from Teneriffe; it is also shipped from Hamburg and France. Dr. de Lanéssan, writing to one of us from Vigo in 1872, remarks that vast quantities of rye are grown in Galicia, and that owing to the humidity of the climate, the grain is extensively ergotized,—in fact the parasite is present in one ear out of every three. At the time of harvest the ergots are picked out, and the rye is thus rendered fit for food.

Southern and Central Russia furnish considerable supplies of the drug. In the central parts of Europe, ergot does not everywhere occur

[1] See Müntz in *Comptes Rendus*, lxxvi. (1873) 649.

[2] The red colour of an alcoholic solution may serve for the detection of small quantities of ergot in flour. The reaction with potash, and evolution of the characteristic odour of herring brine may assist in the same object. Extraction of the fatty oil with carbon bisulphide may also be recommended as a test, inasmuch as good cereal grains contain but a very small percentage of fat.

in sufficient abundance to be collected, and it greatly diminishes as the state of agriculture improves. We have noticed that ergot from Odessa was of a slaty hue and in much smaller grains than that from Spain.

Uses—Ergot is principally used on account of its specific action on the uterus in parturition.

Other Varieties of Ergot—*Ergot of Wheat*, which is in shorter and thicker ergots than that of rye, is picked out by hand in some parts of Italy and France, from grain intended to be used for the manufacture of vermicelli and other pastes; and such ergot is sold to druggists. Carbonneaux Le Perdriel [1] has endeavoured to show that it is less prone to become deteriorated by age than that of rye, and that it never produces the deleterious effects sometimes occasioned by the latter.

The same writer asserts that *Ergot of Oat* is sometimes collected and sold either *per se*, or mixed with that of rye. It differs from the latter in the ergots being considerably more slender.

Ergot of the North African grass known as *Diss*, *Arundo Ampelodesmos* Cirillo, has been collected for use, and according to Lallemant [2] is twice as active as that of rye. It is from 1 to 3 inches long by only about $\frac{1}{16}$ of an inch broad, generally arched, or in the large ergots twisted spirally. We find it to share the structural character of the ergot of rye.

ALGÆ.

CHONDRUS CRISPUS.

Fucus Hibernicus; Carrageen,[3] *Irish Moss*; F. *Mousse d'Irlande, Mousse perlée*; G. *Knorpeltang, Irländisches Moos, Perlmoos.*

Botanical Origin—*Chondrus crispus* Lyngbye (*Fucus crispus* L.), a sea weed of the class *Florideæ*, abundant on rocky sea-shores of Europe from the North Cape to Gibraltar, also on the eastern coasts of North America.

History—Carrageen was introduced to the notice of the medical profession in England in 1831, and shortly afterwards attracted attention in Germany. It was never admitted to the London or British pharmacopœia, and is but little esteemed in medicine.

Description—The entire plant is collected: in the fresh state it is soft and cartilaginous, varying in colour from yellowish-green to livid purple or purplish-brown, but becoming after washing and exposure to the sun, white or yellowish, and when dry, shrunken, horny and translucent.

The base is a small flattened disc, from which springs a frond or thallus 4 to 6 inches or more in length, having a slender subcylindrical stem, expanding fan-like into wedge-shaped segments, of variable breadth, flat or curled, and truncate, emarginate or bifid at the summit.

[1] *De l'Ergot de Froment et de ses propriétés méd.* (these) Montpellier, 1862.

[2] *Etude sur l'Ergot du Diss*, Alger et Paris, 1863; *Journ. de Pharm.* i. (1865) 444.

[3] Carrageen is Irish [illegible] of the rock. We learn from an Irish scholar that it would be more correctly written *carraigeen*.

The fructification consists of tetraspores or cystocarps, rising but slightly from the substance of the thallus, and appearing as little wart-like protuberances.

In cold water, carrageen swells up to its original bulk, and acquires a distinct seaweed-like smell. A quantity of water equal to 20 or 30 times its weight, boiled with it for ten minutes, solidifies on cooling to a pale mawkish jelly.

Microscopic Structure—The tissue of *Chondrus crispus* is made up of globular or elongated, thick-walled cells. The superficial layers on both sides of the lobes constitute a kind of peel, easily separable in microscopic sections. The interior or medullary part exhibits a much less densely packed tissue formed of larger cells. The larger cavities of this tissue contain a granular mucilaginous matter, assuming a slight violet tinge on addition of iodine. In water however, the cell-walls swell up so as to form a gelatinous mass, in which separate cells can at last be scarcely distinguished.[1] In the fresh state, its cells also contain granules of chlorophyll imbued with a red matter, termed *Phyco-erythrin*. But by washing and exposure to the air, these colouring substances are removed or greatly altered, and are no longer visible in the commercial drug.

Chemical Composition—The constituents of carrageen are those generally found in marine algæ, especially as regards the mucilage. This latter is insoluble in an ammoniacal solution of copper (Schweizer's test); by the action of fuming nitric acid, it yields, in common with gum, an abundance of mucic acid. The mucilage of carrageen, like many similar bodies, obstinately retains inorganic matter; after it had three times been dissolved in water, and as many times precipitated with alcohol, we found it still to yield the same quantity of ash as the raw drug itself, that is to say, more than 15 per cent. The mucilage perfectly dried, is a tough horny substance, of a greyish colour; it quickly swells up in water, forming a jelly which is precipitable by neutral acetate of lead.

According to Blondeau,[2] the mucilage of carrageen contains 21 per cent. of nitrogen and 2·5 of sulphur, a statement which we are able to point out as erroneous. We find in it no sulphur, and only 0·88 per cent. of nitrogen. The drug itself yielded us not more than 1·012 per cent. of nitrogen.

When thin slices of the plant are treated with alcoholic potash, and then after washing left for 24 hours in contact with a solution of iodine in potassium iodide, they acquire a deep blue; yet, starch granules are not found in this seaweed. Lastly in connexion with carrageen may be mentioned *Fucusol*, an oily liquid isomeric with furfurol, obtained by boiling seaweeds with dilute sulphuric acid.

Commerce—The plant is collected on the west and north-west coast of Ireland: Sligo is said to be a great depôt for it. It is also gathered to some extent on the coast of Massachusetts, where a systematic process of preparing it for the market is adopted.[3] Carrageen of superior quality is sometimes imported from Hamburg.

[1] Spirit of wine, glycerin or a fatty oil, are the liquids most suited for the microscopic examination of this drug.

[2] *Journ. de Pharm.* ii. (1865) 159.

[3] G. H. Bates in *Pharm. Journ.* xi. (1870) 298.

Uses—The mucilaginous decoction and jelly which carrageen ffords, are popular remedies in pulmonary and other complaints; but s nutriment, such preparations are much over-estimated.[1]

Carrageen is sometimes used for feeding cows and calves; and under he name of *Alga marina*, for stuffing mattresses. Its mucilage serves or thickening the colours employed in calico-printing, and as size for aper and for cotton goods. In America it is used for fining beer.

Substitutes—*Gigartina mammillosa* J. Ag. (*Chondrus mammillosus* Grev.) is collected indiscriminately with *Ch. crispus*. It is distinguished rom the latter chiefly by having the flat portion of the thallus beset rith elevated or stalked tubercles, bearing the cystocarps; but it has the ame properties. *G. acicularis* Lamour., a species common on the coasts f France and Spain, and having slender cylindrical branches, is ccasionally collected along with *Chondrus crispus*. Dalmon (1874) who as examined it, asserts it to be less soluble in boiling water than true arrageen. Small quantities of other sea weeds are often present hrough the negligence of the collectors.

FUCUS AMYLACEUS.

Alga Zeylanica; Ceylon Moss,[2] *Jaffna Moss.*

Botanical Origin—*Sphærococcus lichenoides* Agardh. (*Gracillaria ichenoides* Grev., *Plocaria candida* Nees), a light purple or greenish ea-weed, belonging to the class *Florideæ*, occurring on the coasts of Ceylon, Burma and the Malay islands.[3]

History—Ceylon moss has long been in use among the inhabitants f the Indian Archipelago and the Chinese. It is probably one of the lants described by Rumphius[4] as *Alga coralloides*. In recent times it ras brought to the notice of European physicians by O'Shaughnessy.[5]

Description—The plant, which as found in commerce is opaque and white, having been deprived of colour by drying in the sun and air, consists of cylindrical ramifying stems or filaments, $\frac{1}{10}$ of an inch in diameter nd from 1 to 6 or more inches in length. The main stems bear umerous branches, simple or giving off slender secondary or tertiary amifications, ending in a short point. When moistened, the plant ncreases a little in volume, becomes rather translucent, and frequently xhibits whitish globular or mammiform fruits (cystocarps). It is omewhat friable, and after drying at 100° C. may easily be powdered. It is devoid of taste and smell, in this respect differing from nost sea weeds.

[1] A person must eat a *pound* of stiff jelly made of the powdered sea-weed, before he would have swallowed *half an ounce* of dry solid matter.

[2] For convenience we accept the popular name of *moss*, though it is incorrect.

[3] The *Pharmacopœia of India* (1868) names *Sphærococcus confervoides* Ag. (*Gracillaria* Grev.), a plant of the Atlantic Ocean and Mediterranean, not uncommon on the shores of Britain, as furnishing a portion of the drug under notice. Specimens which we have examined, are widely different in structure from *S. lichenoides*, and are apparently devoid of starch.

[4] *Herb. Amboin.*, vi. lib. xi. c. 56.

[5] *Indian Journ. of Med. Science*, Calcutta, March, 1834; *Bengal Dispensatory*, 1841. 668.

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